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AUTHOR INDEX

Antonitis, Joseph J. 121
Boes, Roderick H. 153
Brown, W. Lynn 113
Caldwell, Willard E. 3, 143, 153, 161
Chalfen, Leo 264
Cumings, Ruth 37
Estes, Betsy Worth 219
Fancher, Edwin C. 81, 89
Feddersen, W. E. 113
Gelber, Beatrice 31
Hall, John F. 245
Hoffeld, Donald R. 143
Hofstaetter, Peter R. 95
Israeli, Nathan 279
Katz, Jerrold J. 3
King, John A. 223
Kish, George B. 121
Kline, Milton V. 37
Koch, Helen L. 231
Lebo, Dell 61
Littman, Richard A. 11
O'Connor, James P. 95
Orgel, Arthur R. 203
Plenderleith, Mavis 107
Robinowitz, Ralph 25
Rubin-Rabson Grace 167
Sherman, Murray H. 133
Smith, James C. 203
Smith, Walter D. 61
Spivack, Sarah Scherer 183
Stebbens, William C. 161
Strauss, Anselm L. 211
Thaler, William D. 3
Tyler, Leona E. 175
Warren, J. M. 77, 245
Weinstein, Morris 81, 89
Young, Florene M. 251

[illegible] Edn. [illegible] Research
Dated ... 3.9.70
[illegible] g- 310

TABLE OF CONTENTS

The utilization of temperature change as motivation and reinforcement in the maze performance of albino mice 3
By Willard E. Caldwell, William D. Thaler, and Jerrold J. Katz

Infantile experience and adult behavior in the white rat 11
By Richard A. Littman

Learning the relation of opposition as related to scores on the Wechsler Intelligence Scale for Children 25
By Ralph Robinowitz

Investigations of the behavior of *Paramecium aurelia:* III. The effect of the presence and absence of light on the occurrence of a response . . . 31
By Beatrice Gelber

A study of the learning characteristics of public health nurses in relation to mental health education and consultation: IV. Kuder vocational interest patterns 37
By Milton V. Kline and Ruth Cumings

Some changing aspects of the self-concept of pubescent males 61
By Walter D. Smith and Dell Lebo

Some stimulus variables affecting the discrimination of objects by monkeys 77
By J. M. Warren

A Szondi study of developmental and cultural factors in personality: The seven-year-old 81
By Edwin C. Fancher and Morris Weinstein

A comparative study of adolescents with the Szondi test 89
By Edwin C. Fancher

Anderson's overlap-hypothesis and the discontinuities of growth . . . 95
By Peter R. Hofstaetter and James P. O'Connor

Discrimination learning and discrimination reversal learning in normal and feebleminded children 107
By Mavis Plenderleith

Spatial learning from different positions in a room 113
By W. E. Feddersen and W. Lynn Brown

Unconditioned operant behavior in two homozygous strains of mice . . 121
By George B. Kish and Joseph J. Antonitis

BOOKS 131

CRITICAL REVIEWS OF RECENT BOOKS 133

Schafer, R. *Psychoanalytic Interpretation in Rorschach Testing.* (Reviewed by Murray H. Sherman) 133

BOOKS RECENTLY RECEIVED 139

An investigation of light avoidance as motivation in a perceptual differentiation problem in the cat 143
By Willard E. Caldwell and Donald R. Hoffeld

The application of light avoidance in a perceptual differentiation problem in the Pekin duck 153
By Willard E. Caldwell and Roderick H. Boes

An investigation of geotropism utilized as motivation in the maze performance of golden hamsters 161
By Willard E. Caldwell and William C. Stebbens

Item order and difficulty in four verbal subtests of the Bellevue-Wechsler Scale 167
By Grace Rubin-Rabson

A comparison of the interests of English and American school children . . 175
By Leona E. Tyler

A study of a method of appraising self-acceptance and self-rejection . . 183
By Sarah Scherer Spivack

A test of the magnetic theory of homing in pigeons 203
By Arthur R. Orgel and James C. Smith

The learning of rôles and of concepts as twin processes 211
By Anselm L. Strauss

Some mathematical and logical concepts in children 219
By Betsy Worth Estes

Sexual behavior of C57BL/10 mice and its relation to early social experience 223
By John A. King

Sissiness and tomboyishness in relation to sibling characteristics . . . 231
By Helen L. Koch

Discrimination of visual patterns as a function of motivation and frequency of reinforcement 245
By J. M. Warren and John F. Hall

Response of juvenile delinquents to the Thematic Apperception Test . . 251
By Florene M. Young

Leisure-time adjustment of the aged: II. Activities and interests and some factors influencing choice 264
By Leo Chalfen

BOOKS 277

CRITICAL REVIEWS OF RECENT BOOKS 279

Piaget, J. *The Construction of Reality in the Child.* (Reviewed by Nathan Israeli) 279

BOOKS RECENTLY RECEIVED 289

The Journal of Genetic Psychology, 1956, **88**, 3-9.

THE UTILIZATION OF TEMPERATURE CHANGE AS MOTIVATION AND REINFORCEMENT IN THE MAZE PERFORMANCE OF ALBINO MICE*

Department of Psychology, The George Washington University

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A. INTRODUCTION

In a previous expediment performed by Caldwell and Mosman (1), albino mice were subjected to an experimental design where they were placed in a maze that had a low temperature in the maze and a high temperature in the goal box. The performance of these animals was recorded in time and errors. This present experiment will be an elaboration of the application of the utilization of temperature in maze learning experiments.

B. STATEMENT OF THE PROBLEM

The purpose of this experiment may be stated operationally as follows: What is the nature of the time and error curves for a group of albino mice subjected to a maze with a temperature of 110 degrees Fahrenheit and with a goal box temperature of 66 degrees Fahrenheit, as compared with the time and error curves for a control group of mice subjected to the same pattern but with the maze having a temperature of 70 degrees Fahrenheit and the goal box having a temperature of 70 degrees Fahrenheit? In this experiment both the experimental and control groups will be sated for other manipulatible drives, such as hunger, thirst, etc.

C. APPARATUS

The apparatus for this experiment consisted of a metal maze pattern with six blind alleys. The metal maze pattern rested on a thin sheet of thin wire. The top of the maze was sealed off by a piece of glass. Underneath the maze pattern there was an electric grill which rested in a copper pan. This grill would be turned on, and the temperature was increased until the desired degree was reached on the thermometer placed within the maze.

There was an intermediate zone between the maze and the goal box which

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[1] The authors wish to express their appreciation to Miss Judith R. Burrows for assistance received in the preparation of this paper.

when the animal would enter would be sealed off from the maze proper by means of a sliding door. There was in this intermediate zone another sliding door leading to the goal box. The floor of the goal box was covered with thin screening wire and underneath the wire there was a tray of ice

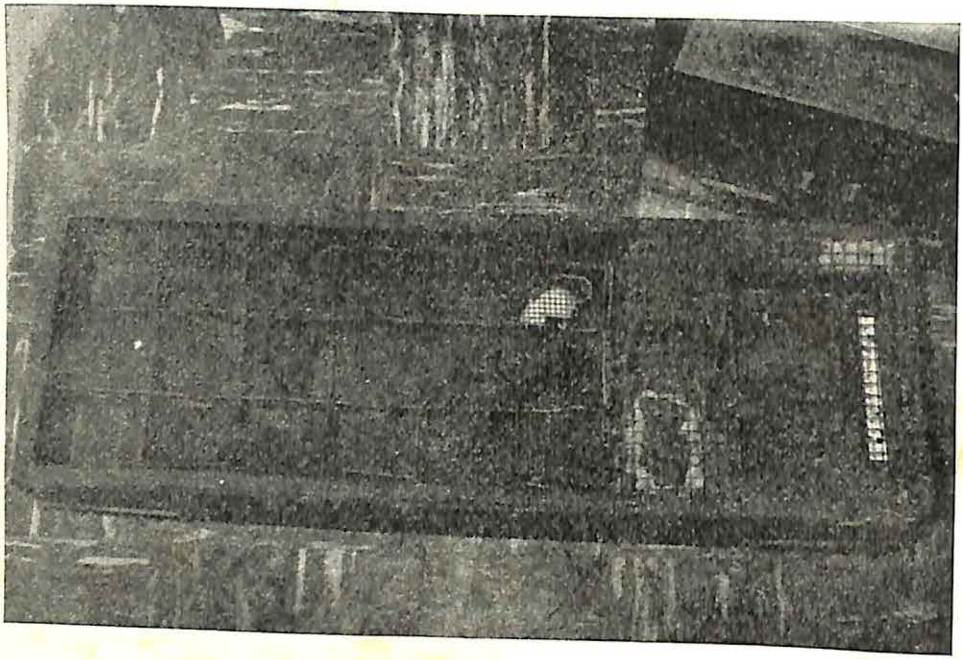

FIGURE 1
A PICTURE OF THE APPARATUS USED IN THIS EXPERIMENT

and some thermometers which would allow the desired degree of temperature to be measured. The maze rested on a table and was surrounded by black cloth. The area enclosed by the black curtains was lighted by a single fluorescent unit containing four tubes, which were 36 inches long and each had a strength of 40 watts. See Figure 1 for a picture of the apparatus.

D. PROCEDURE

The mice utilized in this experiment were females from the National Institute of Health General Purpose Strain. The animals were approximately four weeks old. A total of 12 mice were used in the experimental group and 12 were used in the control group. When 2/3 of an animal's body went into a blind alley, that was counted as an error. When an animal would turn back in the maze, this was counted as a retrace until he returned to the point from which the retrace began. When the animal entered a blind alley during a retrace, this was counted as an error, as well as a retrace. Time was recorded with a stop watch from the time the door of the entrance compartment leading into the maze was opened until the door to the goal box was closed.[2] The animals were allowed to remain in the goal box for five minutes. Temperatures were recorded at the entrance compartment and the goal box at the beginning of each trial, and also when the animals were removed from the goal box.

This experiment was repeated twice, with six animals in the experimental group and six animals in the control group for each repetition. It was necessary in this experiment to have at least two experimenters. The animals were run for 20 trials, approximately between 1:00 and 3:30 P.M.

Each animal was maintained in a separate jar which contained food and water at all times. At the end of each trial each animal's jar was emptied, washed, and filled with fresh food and water. The temperature was recorded daily in the laboratory and averaged around 75 degrees Fahrenheit as the laboratory was thermostatically controlled.

E. RESULTS

Time data reveal significant *F* values between control and experimental groups at the 5 per cent level at Trials 2, 3, 4, 8, 10, 11, 12, 13, 15, 16, 17, 18, 19, and 20. Time data (Table 1) reveal significant *t* values (for only those groups which *F* test shows no significance) between control and experimental groups (with the experimental group taking less time) at the 5 per cent level at Trials 1, 6, and 14, and at the 1 per cent level on Trial 14.

Error data reveal significant F values between control and experimental groups at 5 per cent levels for Trials 2, 3, 4, 7, 11, 12, 14, 16, 17, 19, and 20.

Error data (Table 2) reveal significant *T* values (for only those groups which *F* test shows no significance) at the 5 per cent levels (with the experimental making less errors than the control) on Trial 6.

The shape of the time curve (Figure 2) for the experimental group is an ascending and descending one; for the control group it is a continually ascending one.

The shape of the error curves for the experimental group is an ascending one and then it gradually begins to descend. The error curve for the control group gradually ascends throughout the 20 trials.

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[2] There was, however, a 10-minute time limit in the maze.

F. DISCUSSION OF RESULTS

The time and error curves in this experiment tend to resemble somewhat the time and error curves reported in the experiment by Caldwell and Womack (2), where light avoidance was utilized as motivation. This type of curve was somewhat similar to the curve of time for the experimental, Part 2 of the experiment reported by Caldwell and Mosman (1).

TABLE 1
MEAN TIME IN SECONDS FOR EXPERIMENTAL AND CONTROL GROUPS†

Trial	$\overline{X}_c$	$\overline{X}_e$	S_c	S_e	F	t
1	49.42	64.92	31.49	39.71	1.59	2.08*
2	14.92	33.42	11.74	36.17	9.48*	——
3	8.33	39.50	5.02	26.36	27.55*	——
4	12.00	19.33	9.44	17.41	3.83*	——
5	11.58	16.83	18.58	13.28	1.96	1.56
6	27.42	58.58	53.37	68.64	1.65	2.43*
7	16.83	18.83	19.05	15.76	1.46	0.55
8	36.50	117.17	71.03	169.87	5.71*	——
9	38.83	62.08	66.98	74.65	1.24	1.56
10	70.17	161.58	109.05	220.41	4.09*	——
11	55.92	143.97	87.14	222.95	6.44*	——
12	74.33	174.58	122.58	250.65	4.18*	——
13	59.50	207.08	83.73	239.72	8.20*	——
14	78.17	194.67	160.52	196.83	1.50	3.11**
15	76.33	207.00	100.00	214.49	4.58*	——
16	81.00	245.83	126.54	232.88	3.26*	——
17	29.67	268.91	44.14	265.00	36.04*	——
18	45.50	340.58	90.12	240.81	7.14*	——
19	25.50	358.67	54.64	221.87	16.48*	——
20	30.83	408.83	74.37	230.08	5.36*	——

†For all trials at the 5 per cent level of significance an *F* value of 2.82 is required. For all trials at the 5 per cent level of significance a *t* value of 2.074 is required; at the 1 per cent level of significance a *t* of 2.819 is required.

*Significance at 5 per cent level.

**Significance at 1 per cent level.

G. SUGGESTIONS FOR FURTHER RESEARCH

The following are different problems that might be investigated by this design in which the following might vary:

1. The temperature in the maze.
2. The species.
3. The number of trials.
4. The time interval between trials.
5. The complexity of the maze.
6. The length of time in the goal box.

H. Summary and Conclusions

In this experiment 24 sated albino mice were utilized, 12 in the experimental group and 12 in the control group. The experimental group was placed in a maze which had a temperature of 110 degrees Fahrenheit. The control group was placed in a maze which had a temperature of 70 degrees and a goal box of 70 degrees Fahrenheit. Both groups were allowed to run the maze for 20 trials. The following conclusions may be drawn from this experiment.

TABLE 2

Mean Errors for Experimental and Control Groups†

Trial	$\overline{X}_c$	$\overline{X}_e$	S_c	S_e	F	t
1	3.42	4.08	4.04	3.64	1.24	0.83
2	0.58	1.92	0.95	2.63	7.54*	——
3	0.97	1.42	0.28	2.02	49.44*	——
4	0.25	1.08	0.59	1.89	10.26*	——
5	0.33	0.67	1.10	0.94	1.37	1.55
6	0.92	1.83	1.94	2.66	2.43	2.12*
7	1.00	0.58	2.02	1.19	2.89*	——
8	1.58	3.33	3.62	5.15	2.02	1.88
9	1.58	1.75	3.86	2.49	2.41	0.27
10	2.67	3.75	4.21	3.99	1.11	1.27
11	3.00	1.92	6.27	2.57	5.96*	——
12	4.92	3.33	7.66	4.01	3.64*	——
13	3.58	3.08	5.36	3.84	1.94	0.51
14	5.17	2.67	11.81	3.22	13.41*	——
15	2.75	2.92	4.51	4.13	1.19	0.19
16	2.67	2.67	6.22	3.59	3.00*	——
17	1.92	3.92	3.12	5.90	3.58*	——
18	2.33	4.50	4.82	7.06	2.14	1.72
19	1.00	7.00	1.87	9.00	23.13*	——
20	0.67	5.00	1.44	5.53	14.36*	——

†For all trials at the 5 per cent level of significance an *F* value of 2.82 is required. For all trials at the 5 per cent level of significance a *t* value of 2.074 is required; at the 1 per cent level of significance a *t* of 2.819 is required.

*Significance at 5 per cent level.

**Significance at 1 per cent level.

1. Error data reveals significant *F* values between control and experimental groups at 5 per cent level for Trials 2, 3, 4, 7, 11, 12, 14, 16, 17, 19, and 20. Error data show significant *t* values (for only those groups which *F* test shows no significance) at the 5 per cent levels (with the experimental making less errors than the control) on Trial 6.

2. Time data reveal significant *F* values between control and experimental groups at 5 per cent level at Trials 2, 3, 4, 8, 10, 11, 12, 13, 15, 16, 17, 18, 19, and 20. Time data reveal significant *t* values (for only those

groups which *F* test shows no significance) between control and experimental groups (with the experimental group taking less time) at the 5 per cent level at Trials 1, 6, and 14, and at the 1 per cent level on Trial 14.

3. The general shape of both the time and the error curves for the ex-

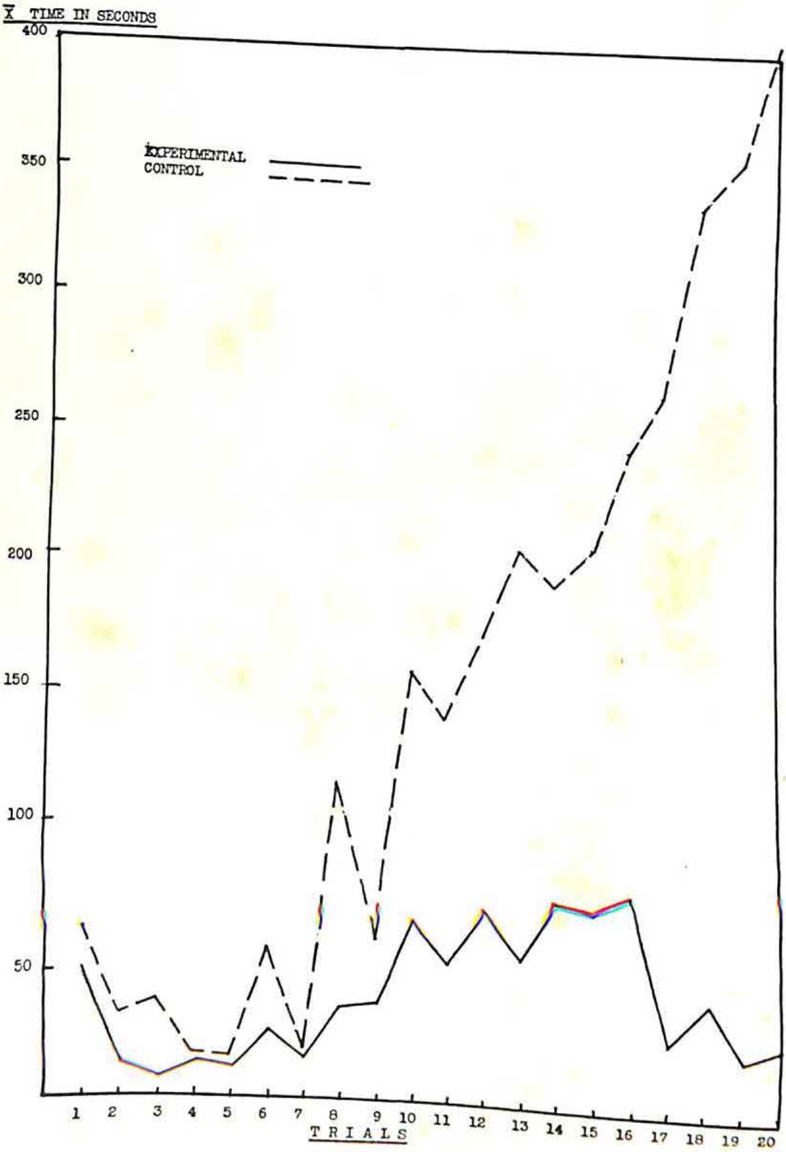

FIGURE 2

Curves Representing Mean Time in Seconds for Both Experimental and Control Groups perimental group resembled a bell shape, similar to the time and error curves reported in the experiment by Caldwell and Womack (2) on light avoidance.

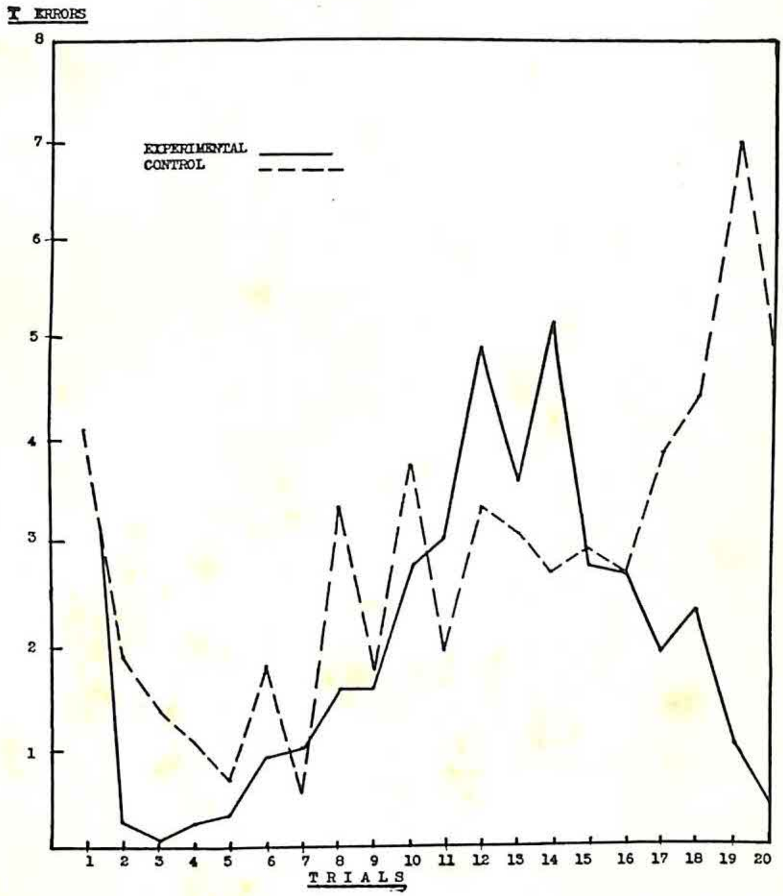

FIGURE 3
CURVE REPRESENTING MEAN ERRORS FOR BOTH EXPERIMENTAL AND CONTROL GROUPS

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1. CALDWELL, W. E., & MOSMAN, K. F. The rôle of temperature change as reinforcement. *J. of Psychol.*, 1951, **32**, 231-239.
2. CALDWELL, W. E., & WOMACK, H. L. The performance of albino mice in the maze situation with the utilization of light as motivation and its relative absence as reinforcement. *J. of Psychol.*, 1953, **35**, 353-360.

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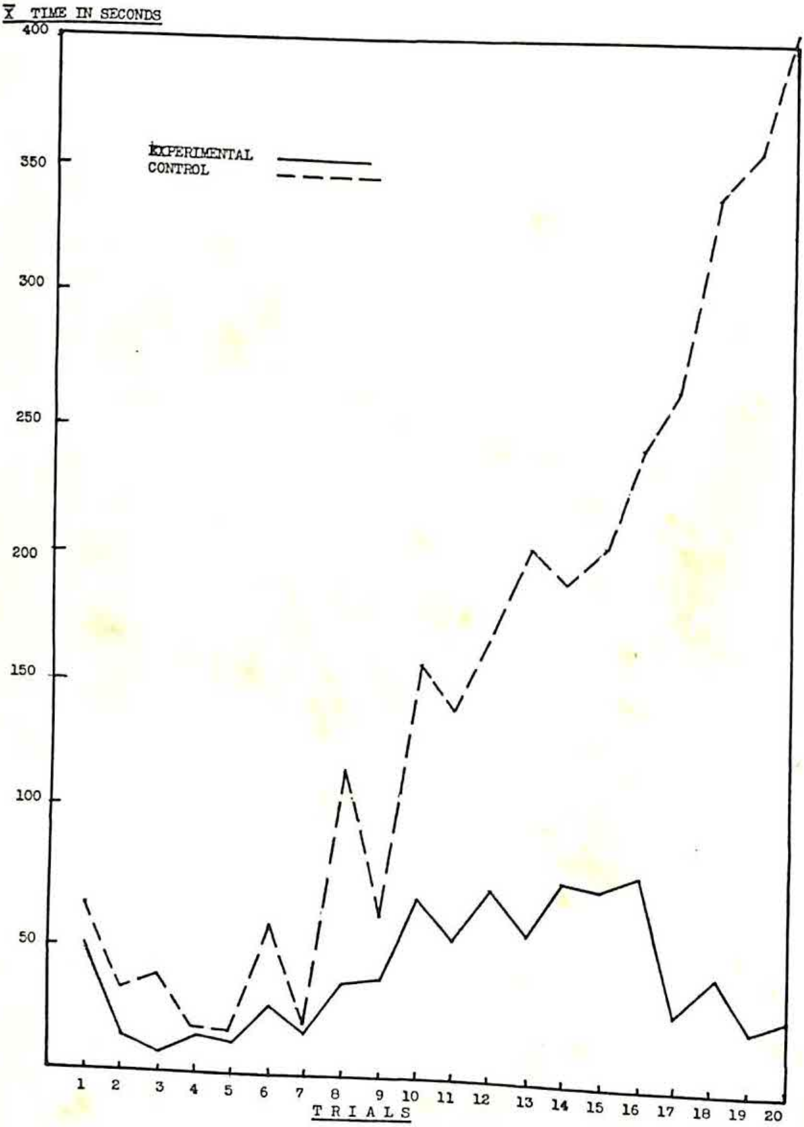

FIGURE 2

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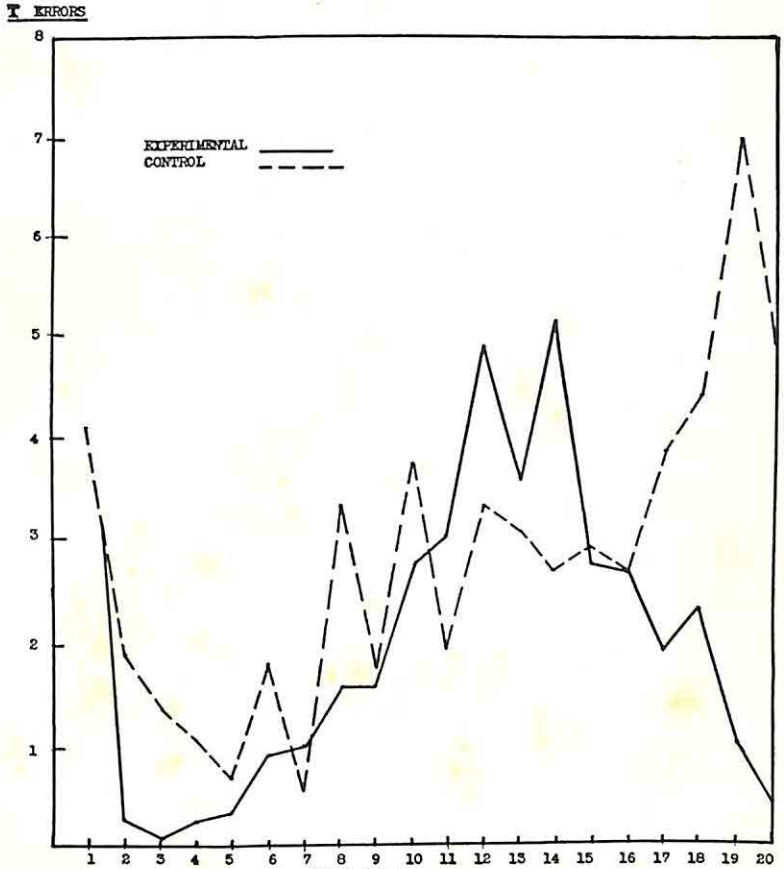

FIGURE 3

Curve Representing Mean Errors for Both Experimental and Control Groups

References

1. Caldwell, W. E., & Mosman, K. F. The rôle of temperature change as reinforcement. *J. of Psychol.,* 1951, **32**, 231-239.
2. Caldwell, W. E., & Womack, H. L. The performance of albino mice in the maze situation with the utilization of light as motivation and its relative absence as reinforcement. *J. of Psychol.,* 1953, **35**, 353-360.

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INFANTILE EXPERIENCE AND ADULT BEHAVIOR IN THE WHITE RAT*

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A. INTRODUCTION

It can scarcely be doubted that the experiences of childhood are related to adult behavior and personality. There exists a wide range of data and informal observations to serve as evidence. What is lacking is any general agreement upon the nature of the relationship, the causal mechanisms, so to speak. Consequently, one finds at least two broad types of theory competing with one another to explain the data.

Consider, for example, an item of behavior like an aggressive act by an adult. How is it related to earlier experiences? One type of theory posits a *redintegrative* phenomenon. The adult behavior is, essentially, a reproduction of earlier behavior. There are two sub-types here. One, the *specificity* point of view, suggests that infantile or childhood events have a restricted effect; the adult aggression has precisely the same meaning and determinants that it had in the child. The second sub-type, the *generality* view, states that the effects are wide ranging and determine many kinds of behavior which were never involved in the earlier act.

The other type of theory, which we have called developmental,[2] grants that there is a relationship between earlier events and later behavior. How-

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[1] The research reported here was supported by a series of grants from the Graduate School of the University of Oregon. We wish to express our gratitude to Mr. R. Blaha who served as technician throughout the study. We are tremendously indebted to Professor O. H. Mowrer who permitted us to review a large collection of unpublished materials dealing with the same phenomena herein reported.

[2] The two types of theory are more appropriately named the discontinuity and continuity views. However, since these terms have already been applied to a specific topic in discrimination learning, it would only create confusion to use them in this context. This would be especially grievous since those who hold a continuity view with respect to one problem most likely would hold a discontinuity view for the other. The continuity theorist in the field of perceptual learning generally has an *S-R* approach. But *S-R* theorists also conceive of habits in redintegrative terms. Hence while their formation is continuous, habits may be elicited in a discontinuous fashion; unless certain conditions hold intervening events have no necessary effect upon the structure of the habit. The argument for those who hold an organizational-cognitive viewpoint with respect to habit formation and elicitation is just about the reverse. Depending upon the degree of "trace communication" which is postulated by the organizational theorist, the distinction is more or less sharp.

ever, in contrast with the *redintegrative* viewpoint, the earlier experiences are said to be capable only of initiating a chain of events which may eventually bring about a certain kind of behavior. Hence, whether the adult behavior resembles the earlier behavior depends, not upon the occurrence of the earlier behavior, but only upon the nature of the intervening experiences; more exactly, upon the immediate antecedents. This is not a problem of immediate versus removed or distant causation; in such a case of course, it is completely arbitrary as to which member of a chain of events one wishes to designate as *the* cause. As we understand it, however, the arbitrary selection of a cause can occur only where each term in the series can be shown to satisfy at least the conditions of necessity or sufficiency. The developmental viewpoint asserts that earlier events cannot be shown to be either necessary or sufficient for later behavior; an indefinite range of earlier experiences may converge upon the same adult behavior.

The reader will recognize that the redintegrative view is representative of associationistic theories—behaviorism and psychoanalysis—while the developmental view is more typical of recent ego-psychologies like Rogers' and the field-theory of Lewin. Yet, while there are other differences between these systematic orientations, there are signs of rapprochement and realignment. As Orlansky (10) has stressed, there are not sufficient data for any conclusive decisions at present. Perhaps the differences in the various theories will disappear as more becomes known. In any case, the present investigation is presented primarily as a fact finding study, though its implications for theory are quite clear.

B. PROBLEM

The brilliant investigations of Hunt (3) and Mowrer (8) provided the starting point. Readers of this JOURNAL undoubtedly recall Hunt's experiment, since repeated, verified, and broadened (4). Briefly, an experimental group of infant rats were subjected to an irregular feeding schedule of such severity that their weight was reduced considerably below that of a control group maintained on an *ad libitum* diet. Some 150 days later when weights were again equal, both groups were subjected to a hoarding test under a strong hunger drive (23½ hours deprivation). The animals deprived as infants hoarded significantly more than the non-deprived group. Hence, the relation between infantile experiences and adult hoarding is clearly established. While it is true that adult hoarding is a function of other factors, e.g., age of infantile deprivation, lighting, test device, time of test, etc. (6), the rôle of infantile events seems soundly established for the hoarding function.

Now consider the series of studies reported by Mowrer (8). He trained rats individually in a Skinner box to press a bar for food pellets. The bar was directly above the food delivery tube in most cases. Three animals, each one trained in this manner, were then put into the box together. The bar was removed to the side opposite the food tube and the animals were put on a strong hunger drive. Finally, the only source of food was the pellets obtained by pressing the bar. Initially, all the animals pressed the bar with equal frequency. However, the animal which pressed the bar usually failed to get any food since his companions, who were usually closer to the food tube than he, ate it up before he could get across the box. The animals ceased responding after a while, presumably since the bar pressing response was not being reinforced by food consumption. After several days of near starvation one of the animals usually hit upon a solution; he pressed the bar so rapidly that more food was delivered through the tube than his companions could consume before he got back across the box. There quickly developed a parasitic relationship in which one animal did the work for all three. Mowrer found that the problem solver was usually the animal who, in an independent pre-test, was rated most aggressive. Under the stress of a strong drive, he explains, the aggressive animal was more active and attacked various portions of the box, including the food-delivery bar. These vigorous activities led to the initiation of multiple bar pressing.

Now, what would happen if we combined the two investigations? There are several possibilities. (*a*) The animals with a history of deprivation (traumatized) might become the workers; (*b*) they might become dependent; or (*c*) there might be no discernible effect of infantile deprivation upon this particular psychological function. (*d*) There is still another possibility; while the occurrence of worker-dependent behavior might not be attributable to traumatization, there could be other features of adult behavior which are affected and which are displayed in this situation.

C. PROCEDURE

1. *Subject*

The subjects were 32 albino rats bred and raised in the University of Oregon laboratories. They were descended from the Holtzmann-Sprague-Dawley strain which is a highly purified breed derived partly from Wistar stock. They are characterized by exceptional docility, a distinct convenience for laboratory work.

2. *Apparatus*

All training took place in a Yale-type Skinner box. Its internal dimensions were 22″ by 12″ by 12″. It was sound and air conditioned. The only regular noise to be heard within the box was that from an air pump. The food delivery mechanism was contained in a closed-off portion at one end of the box, so that the relays and solenoids were heard intermittently, whenever the bar was depressed. A delay mechanism made it necessary to release the bar before another pellet of food would be delivered. This prevented acquisition of a response that permitted food to pour out.

Each depression of the bar delivered a single pellet of food weighing 0.45 grams.[3] Because the pellets were so small, a tremendous amount of work was necessary before an animal could get enough pellets to become satiated in an organic sense. Subjects were never placed in the Skinner box directly from their home cage. They were transferred to a small isolation chamber and remained there for 30 minutes before entering the Skinner box. Upon completion of each day's session they were put in the isolation chamber again for 30 minutes before finally being returned to the home cage where they were fed.

3. *Training Schedule*

There were two major phases: an *infantile deprivation* period for the experimental animals and then an *adult* learning and paired-animal situation for the experimental and control animals. Since we duplicated exactly the procedures of Hunt's earlier study (3) to the time of the adult program, we shall not describe them in detail here (see Table 1). At 21 days a number of litters were weaned. At 24 days they were split and divided into two groups of 16, 8 males and 8 females to a group. The experimental animals were fed irregularly for short 10-minute intervals for 15 days while the controls had a continuous supply of wet mash in their cages. The irregular feeding, beside cutting down markedly the total intake, was associated with rather severe traumatization. Food was abruptly removed at the 10-minute mark and all animals were, at some time or other, knocked off the dish to which they clung while it was being removed from the cage. Beginning with the 40th day after birth, all animals were given the same treatment of unlimited food and water for the next 150 days. At no time were they without food or water in their cages. By this time, weight differences had vanished.

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[3] As with all apparatus, the delivery mechanism would occasionally jam. There would ensue rather agitated bar-pressing until the device was set working again. Our records indicate that this condition occurred fairly seldom and just about equally often in both groups. However, this is clearly an instance of intermittant reinforcement. The difference between such reinforcement and regular reinforcement in a Skinner box is dramatic in its effects. There will soon be reported an investigation of the effects of intermittant reinforcement on the paired animal situation which Mr. Leonard Lansky carried out in our laboratory.

a. Adult learning. When the animals were approximately 190 days old both E ($N = 16$) (deprived as pups) and C ($N = 16$) groups were subdivided into a morning (M) and night (N) group and a Day I (DI) and Day II (DII) group. Thus there were 8 animals classified as MDI, 8 as MDII, 8 as NDI, and 8 as NDII.

TABLE 1

SCHEDULE FOR INFANTILE AND ADULT TREATMENT OF ANIMALS

Treatment	Days old
Infantile and Young Adult:	
With litter	0- 20
Weaned	21- 23
Deprived or undeprived period	24-38
Continuous food in cage	39-189
Adult:	
Adapt to new feed plan	190-203
Individual learning	204-215
Paired testing	216-225

They were then given two weeks adaptation to a new feeding schedule so that training in the Skinner box would occur for all animals 23½ hours after the last feeding. The feeding itself consisted of 8 grams per day per animal, one-half the normal ration. Each animal had his own cage so it was easy to determine whether there was any residue from the last feeding. None could be detected during this entire phase of the study. It must be remembered that since the infancy period procedures the animals were *never* without food in their cages.

The training schedule consisted of six sessions of one-half hour duration every other day. Animals were removed from their home cage, placed in an isolation chamber for one-half hour, and then deposited in the problem box in a standard manner. They were trained to press the lever by using the method of approximation. The small tray below the bar and food tube always contained five pellets when animals were first introduced into the box. Upon completion of each of these six sessions, the animals were returned to the isolation chamber again for one-half hour. From there they went to their home cage where they found their daily ration.

By Day 5 all but three of the 32 animals had reached their maximum response rate (responses per 5-minute period)—cumulative plots were linear. The remaining animals showed a sharp jump on Day 6 to a level approximating the others and training was stopped at that point. The animals were then paired on the basis of sex, weight, and response rate.[4] Only same sex animals were paired. The incorporation of weight in the matching stemmed from Mowrer's data. He found weight to be correlated with dominance which was, in turn, correlated with the development of worker behavior. The animals lived in their individual cages for two days after the last training session, still on the reduced diet. Then they were introduced to the final phase of the experiment.

b. Paired behavior in the Skinner box. In accordance with the pairings worked out, the animals were placed two at a time in the box for five days, one-half hour a day. Again, they were run every other day, half of the pairs in the morning and half in the evening as previously indicated. It is worth noting at this point that in Mowrer's study three animals were placed together in the box; while there are certain obvious differences to be expected, it is not felt that they are crucial for this study. As the pairings worked out there was a relatively counterbalanced disposition of animals with respect to time of day run, time of day they had been trained, and the time of day their mates had been trained; viz., three morning trained animals were run in the morning with morning-trained mates, five with an evening-trained animal; three evening-trained animals were run in the evening with evening-trained mates and five with morning-trained animals.

As before, the subjects were on a 23½-hour hunger drive. Both subjects were placed in the box, shoulder to shoulder, facing the food tube at the beginning of each paired session. The bar, however, was now *behind* them, having been transferred to the side of the box opposite its location during training where it was above the food tube. Therefore they were faced with the problem of pressing the bar and going across the length of the cage to the food tube.

Because of the absence of an automatic recording device throughout both phases of the study, manual recording of bar presses was used. *E* followed the practice of recording "bursts" of responses as a unit, a fortunate decision as matters worked out.

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[4] Pairing by rate is now known to be unimportant. A study in our laboratory has yielded conclusive evidence that, under continuous reinforcement, the maximum rate of responding is unrelated to the development of worker or dependent behavior. The results are being prepared for publication.

D. RESULTS

1. *Weight*

As in Hunt's studies, the marked weight disparity which existed between the two groups of animals at the end of the deprivation period had completely disappeared by the time the problem box phase was instituted. Weights were recorded at the end of the training and pairing periods also but did not differ significantly between groups. All males, of course, were heavier than the females.

2. *Individual Training*

In the left hand portion of Table 2 we have recorded the mean response rate per 5-minute period for the last day of individual training. It is apparent that the two groups have achieved very similar response level; the differences between *E* and *C* by sex and total are not significant. Despite the over-all group similarity, one might inquire whether there is any tendency for one group to have consistently better responders, if even by a slight amount. While the over-all mean is in favor of the control group, we note that in only half the pairs is the control animal superior. There is obviously no tendency

TABLE 2
THE MEAN NUMBER OF RESPONSES PER 5-MINUTE PERIODS FOR LAST DAY OF INDIVIDUAL TRAINING AND DURING THE TEST SITUATION

	Training			Test	
	Experimental	Control		Experimental	Control
			Female		
	36.33	34.66		1.50	7.74
	29.66	27.83		5.33	0.00
	21.16	30.33		24.58	0.00
	25.66	18.66		23.24	0.50
	31.50	25.50		0.00	16.66
	32.83	26.83		5.58	0.16
	27.16	29.66		3.08	3.83
	25.83	22.19		26.75	0.83
Mean	28.76	26.95		11.26	3.72
			Male		
	22.66	32.50		2.74	2.91
	20.50	30.80		1.49	8.49
	34.83	29.33		0.00	2.25
	37.33	38.00		2.75	3.16
	30.90	30.33		4.24	9.49
	34.33	33.66		0.41	6.25
	32.00	36.83		0.33	9.83
	30.82	33.50		0.16	4.08
Mean	30.42	33.12		1.51	5.81

for either group to "have the edge" when a pair-by-pair comparison is made. Nevertheless, a difference remains; 6 of the 8 pairs in which experimentals were superior are female. It suggests a sex difference. However, the male experimentals, though poorer than their control mates, achieved a higher response level than the experimental females.

3. *Test Situation*

The thing we are most interested in is whether there is any tendency for deprived or non-deprived animals to become workers. A *worker* is defined as the animal who has the greater response rate on the last two days of testing; his mate is referred to as a *dependent*. The right-hand portion of Table 2 gives the results. It can be seen that in 11 of the 16 pairs the animal which had the greatest number of responses had *not* been deprived as a pup. According to the sign test (2) this superiority of controls is not significant (two-tailed test) since at least 13 out of 16 pairs must be of one sort to be significant at the 5 per cent level. From this it follows that infantile deprivation does not have any differential effect upon tendency to become a worker.

However there are several other relations to keep in mind: (*a*) The five superior experimental animals were females. It will be recalled that out of the 8 pairs in which experimental animals had higher rates during training, 6 were females. The 5 superior females during this test situation come from this group of 6 who were superior in training. Since none of the males were superior during training it suggests a sex factor, perhaps related to that recently demonstrated in the case of hoarding. However, it should be noted that the response rates during training of the superior females were below those of several males who subsequently failed to become workers in the paired situation. This would indicate that the important variable is not the absolute rate of work but the *difference* between rates. (*b*) Three of the experimental worker females have very high rates, more than twice as high as all the controls save one. Festinger's test indicates that this is a significant difference; the mean of the 5 experimental worker females is greater than that of the control workers at the 5 per cent level. (*c*) The mean rate of the non-worker experimental group does not differ significantly from that of the non-worker controls according to the Festinger test.[5]

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[5] The data have been presented in terms of *all* pairs of animals. This is a loose criterion since many animals who are workers by our definition exceeded their mates by only a trivial amount. Is there any substantial change in the picture, then, if we are more exacting and require that only those pairs be analyzed in which the response rate of one member exceeds the other by an amount significant at the 5 per cent level? We have done this, using the sign test to distinguish the pairs. The results are not substantially changed. Three pairs drop out of the pic-

There is another set of data of considerable importance. They reveal certain aspects of the qualitative behavior of the subjects. Let us consider first the *Motility* data. The number of times that behaviors like the following occurred were recorded for each animal: jumpiness, aggression against companion, tube, or bar, copulatory attempts, trying to jump out of the box and so on. In the upper portion of Table 3 it may be seen that the experimental animals (worker and dependent) exhibited more such reactions than did the controls; the difference is significant beyond the 5 per cent level by the chi-square test. However, these motility data were based primarily upon the observations of the author and his assistant, with only one judge at any given time. They are, therefore not very reliable since both judges knew which animal was a control and which an experimental, a splendid opportunity for ill-formed biases and hunches to manifest themselves.

TABLE 3

FREQUENCY DATA FOR ASPECTS OF PAIRED BEHAVIOR: MOTILITY (JUMPING, MOUNTING, FIGHTING) AND MULTIPLE RESPONSES (TWO OR MORE BAR PRESSES WITHOUT REMOVING PAW FROM BAR)

	Experimental	Control	Chi-squared	P
		Motility		
Total such reactions	84	59	4.76	<.02>.05
Kind of multiple responses		*Multiple responses*		
2-4	365	186	58.26	>.01
5 or more	54	43	1.24	<.05
Any kind	419	229	47.12	>.01

However, there is another line of evidence which yields comparable results; these are reported in the lower portion of Table 3 under *Multiple Responses*. These are "bursts" which are defined as two or more responses for the same animal which are made in rapid succession and without removing the paw from the bar. It will be seen that for bursts of 2-4 responses the experimental animals far exceed the controls. For bursts of 5 or more significance is approached. For bursts of any size, the difference is significant beyond the 5 per cent level.

4. *Relation between Training and Test*

In Footnote 4 we have already alluded to the lack of relationship between these two conditions. The question involved is whether the superior animal

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ture; in each case the control animal was superior by an insignificant amount. Out of the 13 remaining pairs, in 8 the control animal was the worker, in 5 the experimental animal. But this does not differ from chance expectancy so the outcome is the same as when we treat all the pairs.

in the test situation also had a higher rate during training. To test this we have computed the rank difference correlation between the number of responses on the last day of individual training and the mean of the last two days of the paired test situation. Rho equals—0.13 which does not differ significantly from zero for 16 pairs. Nor is this simply the result of the development of one superior responder. The correlation between the last training day and the *first* test day is —0.25 which is also not significantly different from zero at the 5 per cent level for 16 pairs.

The initial pairing of the two animals immediately makes itself felt in their output. On Day 1 of the test the mean response per 5-minute period is 2.72 in contrast to a rate of 29.79 on the preceding individual training session.

When one considers the great similarity between the controls and experimentals at the end of training, the uniform drop in output for both groups on the first day of training and the lack of correlation between the two conditions, it seems clear that there is little relation between any specific level reached during training and the output level under the paired test condition.

E. Discussion

The results seem quite straightforward with regard to the relation between infantile deprivation and the appearance of worker behavior. There is none. While this is in sharp contrast to some of the results of Hunt and his colleagues with *hoarding,* there have been other studies e.g., McKelvey and Marx (5) which have failed to confirm their results. Further, though there has been no *exact* duplication of the Hunt studies, it is clear that whatever effect there is of infantile experience upon adult hoarding it is most complicated and probably specific to a relatively narrow range of training and test conditions. Presumably the effect of infantile experiences on such a response as bar pressing is equally restricted if it indeed exists at all. Nevertheless, it is essential to remind the reader that we have not been studying the hoarding function. While there are certain parallels between hoarding and the specific kind of bar pressing response we have investigated it is obvious that the results for one kind of behavior system need not apply to those of another system. We mention this to insure against any hasty generalization or application of our results to hoarding phenomena which have been much more intensively investigated. On the other hand, of course, we would prefer that our own results not be assimilated to the present status of the hoarding problem.

However, let us consider another feature of the behavior of our subjects.

We refer to the *motility* and *burst* data. While the former are admittedly unreliable since they point in the same direction as the burst data, we shall consider them together. The five experimental workers (all females), it will be recalled, far exceeded the control workers. In addition, the experimental dependents had a lower response rate than the control; as might be expected this was not significant, however, since all dependents were very close to zero.

When we consider the burst or multiple-response data, their relevance to the question we started out with is apparent. We follow, here, the mode of analysis offered by Hunt. It seems clear that infantile experiences like we worked with do not determine *who* becomes an adult worker. However, the *kind* of worker, the "style of life" so to speak, may well be affected by such experiences. The experimental worker (all female) far exceeded the control workers in the number of bursts they emitted; the motility data, though untrustworthy, are congruent.

As Hunt did, we observed excessive activity in our experimental pups during the deprivation period; they were much more mobile than the controls. Consider now what happens in the test situation after the animals have all learned a motor response individually. Since there exists ample data that drive strength is not a determinant of rate of learning (1, 11), even if the anxiety which presumably developed with regard to infant deprivation reoccurred during training as a result of the food deprivation schedule, it would have no effect on the rate of learning. However, during the test situation we are dealing with performance rather than acquisition so that if anything resembling the infantile experience occurred it would operate as an added drive element. There is also an additional factor. During training 100 per cent reinforcement occurs. During the test situation, the eating of the food by the non-responding animal amounts to setting up a partial reinforcement schedule. This is very much like some of the conditions which prevailed during infancy deprivation when food was suddenly withdrawn in the midst of eating and, in any case, was presented at very irregular intervals for varying periods of time. Hunt has hypothesized, to explain his hoarding data, that adult deprivation serves to rearouse or redintegrate the "autonomic and humoral responses which served to energize the animals" as pups. This, he proposes, results in an added drive factor which summates with the drive subsequent to adult starving and results in more hoarding.

We, too, assume redintegration of infantile responses to deprivation—including those that attended being knocked off the food dish. But, instead of a direct, energizing effect, as in a hoarding situation, we postulate a more complicated state of affairs. Perhaps we are only reflecting the times, but

8-310

we have adopted an *anxiety-reduction* explanation; probably a frustration or aggression analysis can do as good a job. We propose that it is the reduction in anxiety, consequent upon bar-pressing *or* being fed at the tube which reinforces the behavior of the experimental worker or dependent animal. This amounts to saying that the control animals played a relatively unimportant rôle in the outcome. Where they became dependents they had little choice. The experimental animal, for some reason or other, began to press the bar vigorously. This was reinforced by the reduction in anxiety as he could now get plenty of food at the other end of the box whereas before he could not. The added reduction in anxiety resulted in a very high rate in contrast with that of the control. Similarly, some experimental animals began to "hang around" the food tube. When their companions provided them with pellets, the anxiety attending hunger was reduced and activity in the presence of the food tube was even more strongly reinforced.

Thus anxiety-reduction is postulated as playing a dual rôle. On the one hand, it reinforces those behaviors that involve multiple-bar pressing. On the other, it reinforces behavior incompatible with bar pressing—those that maintain the animal in the vicinity of the food tube. The reduction in anxiety results in a cathected bar or food tube. That attachment to the *tube* would occur seems most likely and, though the differences are not significant, the fact that 11 out of 16 experimentals were relatively more tube oriented than the controls, is suggestive.

The results of infantile experience, in terms of this investigation, therefore, shape up as follows. Certain experiences of infancy result in a tendency for drive states to be associated with food deprivation. These drive states are of an "emotional" sort. They may be redintegrated in the adult with food deprivation and frustration conditions. The reduction in these emotional drive states, along with the reduction in the food drive, combine to increase bar pressing *or* food tube monopolization.

What now of the implications of this study for social behavior? It has been remarked that the rat is harly the animal to study for social principles (9). Certainly there are many areas of social functioning which simply have no place in the life of the rat. And yet there are many forms of human endeavor that are conventionally designated as social which conform in outline to the type of situation we have herein described. For example, the fact that one individual establishes the framework within which another must function, e.g., administrative rules, is considered an object of social psychological research. There is no face to face contact and yet one person's conduct determines another's. We have somewhat the reverse situation in our set up. In a face to face situation one organism establishes its own mode of conduct and his companion is forced to use his own resources in order to function. There is little communication other than an occasional bite, but the monopoly of one or the other part of the box regulates, if not determines, the activity of the other resident. It is, indeed, at just this point that individual psychology may truly be said to join hands with social psychology.

We hesitate to spell out the point but wish to indicate more clearly what we mean. A good deal of the experimental activity of contemporary investigators, especially in the field of learning, concerns the activities of individuals. It is easy to make predictions concerning the solitary activity of the animal based on previously solitary activity. What prediction, however, will be made concerning the relationship between solitary experiences and social situations wherein earlier training may be put into operation? The picture is not clear. And yet it is precisely this type of question which is involved in much of the work on the development of social behavior. To study the effects of sensory deprivation only on solitary animals is to diminish our knowledge of both individual and social determinants of behavior. We have failed to mention up to this point the obvious social factors in the life of our animals. For a certain period they lived under group conditions. Even though there was never any insufficiency of food, there could very well have been competition over this piece of food or that one, for this eating place or some other one. That this would reinstate the anxiety of our experimental animals does not seem unreasonable. It seems just as likely that it might introduce such a factor in the lives of the non-deprived animals. As Christie has recently suggested, it is frequently the pre- and extra-experimental lives of our subjects, human and otherwise, that we should look to for many of our results. A difficult job, but easier with the rat.

There is one loose end. What about the issue raised in the initial portion of the paper concerning a redintegrative versus a developmental version of infantile experience? While the present investigation hardly answers such a broad question, it seems to point to the operation, at least, of some redintegrative factors in behavior. On the other hand, the fact that worker behavior was only indirectly affected by the infantile events should give us pause. It is possible that in some subtle way the infantile events in our study helped determine the adult worker behavior—the sex differences are suggestive of this. But it seems certain that there is no obvious set of effects to be seen. They shall have to be worked out for each phenomenon one is interested in.

F. SUMMARY

Sixteen albino rats were deprived of food in infancy. After this period of deprivation they were treated in identical fashion as their litter mates who were undeprived and served as controls. As adults each animal learned a bar pressing activity. They were then placed in a Skinner box in pairs with the food tube removed to the side opposite the bar. There appeared a tendency for experimental animals to frequent the tube area and thus become dependent upon their control mates. However, those experimental animals who became workers tended to respond with greater vigor than worker controls. It was hypothesized that the reduction of an anxiety state, established in infancy and redintegrated in the adult, served to reinforce both the instrumental acts of bar pressing and tube monopolization.

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LEARNING THE RELATION OF OPPOSITION AS RELATED TO SCORES ON THE WECHSLER INTELLIGENCE SCALE FOR CHILDREN*

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A. HISTORICAL BACKGROUND

1. *Studies on Children's Learning of Logical Relationships*

Psychological studies on children's learning of logical relationships date back at least as far as 1926. In *Psychologischa Forschung* (2) published that year, K. M. Dallenbach reported, in a note, on the results of asking two children the meaning of "opposition." Though neither child, at first, knew the meaning, the older child, a six-year-old, was able to abstract the concept after several examples of words and their opposites had been given him. He was able to use this knowledge, then, to give the opposites of presented words. The younger child, a three-year-old, was never able to make the abstraction.

This initial discovery led Dallenbach and G. M. Kreezer (5) to extend the investigation to a group of children. The children were selected between the ages of five years and seven years, six months (inclusive), an equal number in each six-month age range. This investigation set forth three objectives, which were also adhered to in later investigations: (*a*) To find out at what age children know the meaning of opposition; (*b*) to find out how those children who do not know the meaning of opposition learn the meaning (whether by trial-and-error or by insight); (*c*) to find out at what age children are capable of learning the meaning of opposition. Kreezer and Dallenbach (5) were concerned with all three objectives in this study.

In 1937, M. Schooley and G. W. Hartmann (10) investigated the rôle of insight in the learning of logical relationships. The emphasis here was on the second objective of Kreezer and Dallenbach, to find out how those children who do not know the meaning of opposition learn the meaning. Though Schooley and Hartmann studied other logical relationships than opposition, they used the same procedure that had been previously employed by Kreezer and Dallenbach. Schooley and Hartmann concluded, as did Kreezer and

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Dallenbach, that insight was the manner in which all of these relationships were learned.

In 1939, J. I. Lacey and Dallenbach (6) investigated the acquisition by children of the cause-effect relationship, in a similar manner.

W. Edgar Vinacke (12) has summarized the important studies in this area.

2. *Correlation of Abstract Reasoning Ability With Other Factors*

Interest in correlation of various forms of reasoning with some other factor has existed for some time. It has been pointed out (12) that the relationship between intelligence and concept formation has been assumed through two different principles, which are accepted as facts. The first of these is, that one variable of intelligence, according to most theorists and test constructors, is the ability to form and use concepts. The second is, that one reason for higher measured intelligence is the ability of the individual to conceptualize.

In 1922, Cyril Burt (1, 12) showed interest in the relationship between reasoning and intelligence. Jean M. Deutsche (3) studied the relationship of scores on a test of causal relations to intelligence test scores on the Kuhlmann-Anderson test. She found a low positive relationship.

Louis Long and Livingston Welch (7) feel that chronological age is at least as important as mental age in so far as reasoning ability is concerned.

K. L. Smoke (11) has computed a rank difference correlation between ability to learn concepts rapidly and intelligence test scores on the Ohio State University Psychological Test. He found a rank difference correlation of .52±.125.

Deutsche (3) has summarized the important studies which have correlated concept formation and various other factors.

The literature on the two topics mentioned is broad and extensive. No attempt has been made to present a survey of the literature here. Three surveys (3, 8, 12) have been listed. The purpose of the aforegoing résumé has been to show the development of the present study.

B. HYPOTHESIS

The present paper is concerned with the third objective set forth by Kreezer and Dallenbach in the original experiment. The first objective (At what age children do know the meaning of opposition) was assumed answered from the data of the original experiment (5). The second objective (How do those children who do not know the meaning of opposition learn the meaning) was answered both by the original experiment and by the Schooley-Hartmann (10) experiment.

The third objective (At what age are children capable of learning the meaning of opposition) seems to have been incompletely answered. One inquiry might be to discover the earliest possible age at which the relationship could be learned; another might be to discover the latest age at which an average child would learn the principle.

The present paper is concerned with discovering whether the "brighter" child as measured by an intelligence scale is the one who learns the relation of opposition at an earlier age. Dallenbach and Kreezer (5) found an increasingly larger percentage of children able to learn the relationship with advance in age. It does not seem unreasonable to assume that the children who are able to learn the relationship at a younger age are "brighter" children as measured by score on a test such as the Wechsler Intelligence Scale for Children (13). In the same manner, it might be assumed that those children who were unable to learn the relationship in the seven-year to seven years, six months group would be "duller" children and would register lower scores on the same intelligence scale.

C. EXPERIMENT

1. *The Subjects*

The purpose of this experiment is to study the relationship between the subject's score on the Wechsler Intelligence Scale for Children and his ability to learn the relation of opposition. Ten subjects in each six-month age group between the ages of five years and seven years, six months (inclusive), were used, as in the original study (5). On socio-economic scales, the subjects would fall into the lower and upper middle-class groupings. The majority of the subjects were obtained from an inexpensive housing development for ex-servicemen in a large Texas city. In all, 21 girls and 29 boys were used in the study. No attempt to select for sex or intelligence was made, though the subjects varied in intelligence from dull normal to superior, in terms of Wechsler's classification.

2. *Procedure*

The full standard form of the Wechsler Intelligence Scale for Children was administered to each subject by a qualified Wechsler examiner. In every case, following this, he was given the Relation of Oppositions Test developed from Kreezer and Dallenbach (5). This was administered by a person who had carefully mastered the procedure and had previously had experience working with children. The score on the intelligence test was in no event available to the individual administering the Relation of Oppositions Test.

More complete descriptions of the correct procedure for administering both the Wechsler Intelligence Scale for Children and the Relation of Oppositions Test are available in the original sources (13, 5).

After the scores from the Wechsler Intelligence Scale for Children and the Relation of Oppositions Test were available, the data were treated statistically.

D. RESULTS

Since the purpose here is to discover the relationship existing between ability to learn the relation of opposition, as measured by the criteria of Kreezer and Dallenbach (5), and score on the Wechsler Intelligence Scale for Children, our first task is to determine whether any significant difference exists in intelligence, according to the scale, between those children able to learn the relation and those unable to learn it. This was determined for each six-month age group.

R. A. Fisher's "small-sample" statistics were used because of the size of the samples (4).

TABLE 1

SCORES ON WECHSLER INTELLIGENCE SCALE FOR CHILDREN FOR SUBJECTS IN EACH OF FIVE AGE GROUPS WITH PASS-FAIL ON OPPOSITION LEARNING FROM KREEZER-DALLENBACH CRITERIA

5-5½ yrs.		5½-6 yrs.		6-6½ yrs.		6½-7 yrs.		7-7½ yrs.	
IQ	P-F	*IQ*	P-F	*IQ*	P-F	*IQ*	P-F	*IQ*	P-F
88	F	93	F	89	F	108	P	90	P
91	F	96	F	99	F	111	P	97	P
95	F	102	P	102	F	116	P	100	P
99	F	104	F	112	P	120	P	102	P
104	F	104	F	116	P	120	P	105	P
115	P	116	P	120	P	121	P	109	P
117	P	125	P	120	P	122	P	116	P
117	F	126	P	123	P	125	P	125	P
118	F	127	P	123	P	134	P	126	P
119	P	131	P	125	F	140	P	144	P

For Group I (five years to five years, six months) a *t* ratio of 7.1 was found; for Group II (five years, six months to six years), a *t* ratio of 3.7 was found; for Group III (six years to six years, six months), a *t* ratio of 6.3 was found. Since a *t* ratio of 3.555 is significant for eight degrees of freedom, our ratios are all significant beyond the 1 per cent level.

No *t* ratio was taken on Groups IV and V, since all of the subjects within these groups were able to learn the relation of opposition.

The next step was to study the existing relation, for the entire group, between intelligence test scores and ability to learn the relation of opposition We found, as did Kreezer and Dallenbach (5), that there were subjects ever among our youngest group who were able to learn the relation. This seemed to justify testing the hypothesis as to whether a relationship existed between all of the intelligence test scores and the ability to learn the relation of opposition.

Since the Kreezer-Dallenbach and Schooley-Hartmann experiments (6, 11) have shown learning to take place either immediately here or not at all, a point-biserial correlation was used (4).

A point-biserial coefficient of .609 was obtained. The t test of significance showed this to be significant beyond the 1 per cent level.

The learning of the relationship in each case seemed to take place at once or not at all, as in the original study.

E. DISCUSSION

At this point, it should be mentioned again that this paper is a logical outgrowth of the three objectives set forth by Kreezer and Dallenbach (5). The focus has been on the third objective, which was, to find out at what age children are capable of learning the meaning of opposition.

The findings here are in accord with those of Long and Welch (10) that chronological age is an important factor in ability to learn an abstract relationship. Children scoring below above-average scores on the intelligence scale were unable to learn the relationships unless they were six years, six months, or older. In the seven-year age group, even children at the bottom of the normal range, according to the Wechsler Intelligence Scale for Children, were able to learn the relationships. For the other age groups, learning the relationship seemed to depend on intelligence.

Our results differ from those of Long and Welch (10) in one respect, however. Using a different intelligence scale, and a different measure of ability to learn abstract relationship, we did find *IQ* to be significant.

Our results are more similar to those of Smoke (11) who found a rank difference correlation of .52±.125 between intelligence test performance and ability to learn concepts rapidly.

F. SUMMARY

Fifty children between the ages of five years and seven years, six months, equally divided among six months age groups in this range, were given the Wechsler Intelligence Scale for Children by a qualified examiner. Following this, they were given the Relation of Oppositions Test, devised by Kreezer and Dallenbach (5). The purpose of this was to see whether the children who scored highest on the intelligence test would be the ones learning the relation of opposition first and at an earlier age.

The following conclusion may be drawn from the experiment:

1. The learning of the relationship either took place by insight (at once) or did not take place at all.

2. A significant difference was found in scores on the Wechsler Intelligence Scale for Children, with each six months age group, between those children who were able to learn the relation of opposition and those children who were unable to learn it. Within each age group, the scores of the children who were able to learn the relation were significantly higher than those of children who were unable to learn the relationship, and this significance in each case was beyond the 1 per cent level.

3. A point bi-serial correlation of .609 was found between ability to learn the relation of opposition and scores on the Wechsler Intelligence Scale for Children; this correlation was found to be significant beyond the 1 per cent level.

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INVESTIGATIONS OF THE BEHAVIOR OF PARAMECIUM AURELIA: III. THE EFFECT OF THE PRESENCE AND ABSENCE OF LIGHT ON THE OCCURRENCE OF A RESPONSE*

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A. PROBLEM

One of the earliest studies by a psychologist using paramecium as a subject was reported by Stevenson Smith. He stated that an attempt to condition avoidance in this organism, using heat as the *US* and darkness as the *CS*, did not produce any detectable modification of behavior. Though the terminology used was not Pavlovian, essentially this was Smith's conclusion (4). Bramstedt (1), however, reported in 1936 that he was able to induce avoidance in *Paramecium caudatum,* using light as the *CS* and heat as the *US*. In 1937, Soest (5) reported that avoidance of light but not of darkness could be conditioned by pairing with electric shock. That is, paramecia apparently can be trained to avoid light but not darkness. It would seem, then, that light or darkness may, per se, constitute an important part of the stimulus and a variable meriting investigation, especially since, except for phototaxis in *bursaria,* paramecia are generally considered to be indifferent to ordinary light.

When the writer was asked to set up an experiment for a class in advanced laboratory psychology, she suggested this problem. All cultures were prepared by the writer who also arranged the materials and supervised the preparation for each experimental run. Thus, procedures approached uniformity though each run was done by a different pair of experimenters.

B. PROCEDURE

Cultures of *Paramecium aurelia* of Sonneborn's strain 51, sensitives, mating type VII (6) which are genetically homozygous, were used as subjects.

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[1] The study on which this report is based was completed while the author was at Indiana University.

Aerobacter aerogenes were the bacterial food material used. Since the total number of fissions or divisions (by which these single-celled organisms increase in number) in any culture of paramecia depends on the amount of food present, it is possible to develop cultures of about 128 or 2^7 *P. aurelia* each by isolating single individuals in an amount of food-containing culture fluid sufficient to produce 7 fissions. After some 65 to 70 hours at a temperature about 78 degrees *F*, where a single paramecium has been isolated, there will be found a culture of some 128 paramecia, with very little or no available food material. Such a culture can then be treated experimentally under "hunger" motivation. Such cultures were prepared, with each culture matched by another started from a sister paramecium. Sisters are the two animals which result when a single animal has undergone one fission, producing two paramecia.

Experimental treatment was given on the stage of the microscope, using apparatus previously described (3). This apparatus consists of a piece of Masonite in which is cut a rectangular opening just large enough to hold the slide containing an experimental culture. A piece of platinum wire supported on the Masonite frame can be raised and lowered vertically into the culture of paramecia. A training trial is defined as lowering the wire into the culture and allowing it to remain for 15 seconds, and then raising it for 25 seconds when it is again lowered for the next trial. Forty such training trials were given to all cultures with a very small amount of food material (*Aerobacter aerogenes*) wiped on the wire before every third trial (3), i.e., each culture received training defined as 40 training trials with one-third periodic reinforcement. Before training was started, a preliminary test count was made by lowering the sterile wire into the culture and leaving it there for three minutes. At the end of the three minutes, the number of paramecia adhering to the wire was counted and the wire was raised. Then training was started. After completion of training, the apparatus was removed from the stage of the microscope so that the wire could be washed and sterilized. The apparatus was then replaced with the just trained paramecium culture in position, and the wire lowered for a final test exactly like the preliminary test (except for the difference in lighting noted below). After three minutes, a count of the number of paramecia adhering to the sterile wire was taken. Then, the wire was raised for four minutes and again lowered for three minutes so that a second final test count could be made.

All training trials and preliminary tests were made in the light. For final tests, however, one culture in each pair had the light on throughout the test period, while the other culture was tested in the dark. This was done by turning the light off (see below for a description of lighting) just before the sterile wire was lowered into the culture, and turning the light on again after three minutes so that the experimenter could see to make the test count. *E* was allowed some 20 seconds after the light was turned on to make the test count. This means, of course, that the dark tested group were actually tested in the dark for three minutes and in the light for about 20 seconds. The effect of this on results is discussed later. The wire was then raised for four minutes, the light turned off and the wire lowered for the second test count. The other culture in each pair was tested in the light after being given identical preliminary test and training with the dark tested culture. For light tests, the light was left on at all times. For half the pairs of cultures, the light tested culture was run first, while for the other half, the dark tested culture was run first. Except for the microscope light, the room was in darkness as nearly complete as possible during the entire experiment. Six pairs of cultures were trained and tested by the members of the class, each pair being run by two students who acted as experimental partners.

In order to secure a view of the side of the wire (which made a more accurate count possible), a variation in the method of illumination and position of microscope barrels was introduced. First the barrels of the microscope, through which the view is obtained, were placed in the fully tilted position. Since this also tilted the stage, it was necessary to bring it to a level by placing a false stage on it. Thus, the training wire was perpendicular to the slide when lowered, but the view was from the side. Lighting was from an ordinary incandescent bulb of 60 Watts in a goosneck lamp with a round bottom flask of distilled water, supported on a ring stand, placed between the light and the microscope. The flask of water served both as a coolant to keep the temperature on the microscope stage constant, and to focus the light. The light came from above and was placed at the side (not the back, as conventionally) of the microscope while the substage mirror was tilted sidewise to reflect the light upward toward the side of the wire. Thus, lighting was a combination of incident and reflected light totalling approximately 55 foot candles.

To summarize, matched pairs of cultures of *P. aurelia* were given identical "training" under "hunger" motivation, in the light, to approach a platinum wire. After training, one culture in the pair was tested in the light for wire approaching while the other culture was tested in the dark. Table 1 shows preliminary test counts and mean of two final test counts for each culture.

C. Results and Discussion

Due to a failure in the heating system, the laboratory became very cold while culture Pair 1 was propogated. Cold slows fission. Therefore, culture Pair 1 was found to contain animals still in process of fission and visible bacterial residue (food). These cultures were reported not to be adequately motivated by "hunger" but were run anyway because of demands of the class schedule. As expected, no modification of behavior was shown. These results are reported in Table 1, but the scores for culture Pair 1 were not used in statistical computation of results. Results were evaluated statistically by subtracting the preliminary test count from the mean of the two final test counts for each of the other five pairs of cultures, this figure being taken as representing the change in behavior due to the interpolated training plus the change from light to darkness or no change in lighting during final tests. Then the difference between the change value for the culture tested in the light and its paired culture tested in the dark was taken as representing the effect of light difference during final tests. These figures are represented as *D* in Table 1. Using the *t* test for matched pairs, the probability of such a difference was evaluated. This gave a value of *t* significant at better than the 1 per cent level of confidence. As mentioned above, the dark tested group actually were tested in the light as well for 20 seconds and this would have the effect of attenuating the difference between the groups.

Chi squares were also computed between the preliminary test scores and mean of final test scores for each culture in both groups. These chi squares and their degrees of freedom were summed for each group. For the light tested group, the scores after training compared with the scores before training gave a chi square significant far beyond the 1 per cent level of confidence. A similar chi square for the group tested in the dark has a probability of about 88 per cent. The *t* tests comparing preliminary and final test scores give about the same results as the chi square.

Thus, it is seen that the group tested in the light showed a highly significant increase in response after training, while the group tested in the dark did not show any detectable change in response. Comparison of improvement in response, after training, between the light and dark tested groups gave a value of *t* which indicated that the difference between the groups was highly significant. Since all other conditions were held as nearly constant as possible for both groups, the increased response or lack of it was apparently due to the difference between light and darkness in final tests. It may be noted that the light tested group gave results very similar to those previously reported (3).

TABLE 1

TEST RESULTS FOR ALL CULTURES AND STATISTICAL ANALYSIS

	Light group					Dark group					
Culture	Preliminary test count	Mean of 2 final tests	a. Final minus prelim.	Chi Square prelim. vs. final test	*df* of Chi Square	Preliminary test count	Mean of 2 final tests	b. Final minus prelim.	Chi Square prelim. vs. final test	*df* of Chi Square	**D (a — b)
*1	0	0				0	0				
2	0	5.5	5.5	5.50	1	1	4.0	3.0	0.18	1	2.5
3	1	8.0	7.0	5.44	1	1	2.0	1.0	0.33	1	6.0
4	0	9.0	9.0	9.00	1	0	0.5	0.5	0.50	1	8.5
5	0	6.0	6.0	6.00	1	0	1.0	1.0	0.50	1	5.0
6	3	9.5	6.5	3.38	1	6	4.5	—1.5	0.22	1	8.0
Sum	4	38.0		29.32	5	8	12.0		1.73	5	30.0

$t_D = 5.535$

Σ Chi Square $= 29.32$
Σ *df* 5, $p < .01$

Σ Chi Square $= 1.73$ *df* 4
Σ *df* 5, $p = .88$ $p < .01$

*As noted in the text, results for Culture 1 are not included in the statistical analysis since Culture 1 was not ready.

**See text. *D* refers to the difference between light and dark groups in change from preliminary to final tests (Column *a* minus Column *b*), e.g., for Culture 2, $a = 5.5$; $b = 3.0$; $D = a - b = 5.5 - 3.0 = 2.5$.

D. Summary and Conclusions

By a method previously reported (3), two groups, each consisting of five cultures of *Paramecium aurelia,* were "trained" to approach a platinum wire. One group was tested in the light, after training in the light, while the other group which had received similar training was tested in the dark.

When approach to the wire after training was compared with before training, the group tested in the light showed a highly significant improvement while the group tested in the dark showed no detectable change. The improvement after training of the light tested group exceeded that of the dark tested group at better than the 1 per cent level of confidence. It is concluded, therefore, that the response of approaching the sterile wire after training in the light will be elicited in the light but will not occur noticeably in the dark in *P. aurelia* of this strain, under these conditions. It would seem, then, that a change from light to darkness constitutes an effective change in the stimulus situation for this organism, i.e., the organism is sensitive to change in light intensity of the magnitude here reported (about 55 foot candles). Further investigation, using smaller differences in intensity as well as changes in wave length of light, is planned.

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A STUDY OF THE LEARNING CHARACTERISTICS OF PUBLIC HEALTH NURSES IN RELATION TO MENTAL HEALTH EDUCATION AND CONSULTATION: IV. KUDER VOCATIONAL INTEREST PATTERNS*

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A. INTRODUCTION

The purpose of this paper is to describe the vocational interests of public health nurses in relation to the rôle that such factors may play in public health nurses' response to in-service mental health education and consultation services. As such, this is part of a larger investigation of the personality and learning characteristics of public health nurses in relation to their rôle and participation in mental health services and practices (2, 4, 5). Any consideration of the nature of a specific occupational group must take into account the rôle that vocational interests may play in determining attitudes toward job function and the relationship of job function to a sense of job satisfaction. Often job functions in themselves may take on specific positive or negative significances in relation to the motivations and needs of the individuals in that occupation. Thus, job function can be reacted to not on the basis of the function per se or even its rational justification, but rather on the meaning that the job function may have for the individual on a conscious or unconscious level. The unconscious origins and determinants of job satisfaction are an important though as yet little studied area of psychology (6, 7).

The specific purpose of this study has been to (*a*) evaluate and describe the vocational interest patterns of public health nurses in relation to women in allied occupations, (*b*) to relate these findings to the major problem of predicting the response to and rôle of mental health services within public health nursing.

B. PROCEDURE

The Kuder Preference Record, Vocational, Form *B* (8) was administered to a group of public health nurses from two county health departments. Both groups constituted a reasonable sample of present day public health

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nursing service, practice, and administration within a health department setting

The Kuder Preference Record is a widely-used test of vocational interests based upon a measure of attitudinal response to occupational activity rather than occupation alone. Scores are obtained in the following nine general areas of interest: mechanical, computational, scientific, persuasive, artistic, literary, musical, social service, and clerical.

In order to more adequately develop a comparative description of the relative nature of the public health nurses' vocational interests, several statistical procedures were chosen because of their usefulness in bringing out meaningful comparisons rather than as absolute measures of vocational interest. These techniques are described as they are presented in this paper.

C. RELATED STUDIES

Specific reference as to the vocational interests of public health nurses as an occupational group is virtually non-existent. Though the nursing profession itself has been studied with respect to aspects of such interest, the orientation has been primarily in the direction of selecting nurses and in describing some of the characteristics of nursing students in relation to other students. Public health nursing in recent years has expanded greatly both in size and function. Perhaps the expansion of public health work in general and the incorporation of mental health and related functions has led directly to the increased significance and scope for public health nursing (1). There is little doubt that as an occupational entity the public health nurse exists, yet relatively little is known about the selective determinants of this occupational group or the motives and aspirations which help to determine which nurses go into public health nursing and why they do so.

Kuder (8), in compiling data for the Kuder Preference Record, reports on mean scores and standard deviations of women in various occupational groups in the manual for that test. There are mean scores for trained nurses in the sample used by Kuder which show the nurse to have a very high social service interest scale followed by a high scientific interest scale and high average scales in mechanical, persuasive, and artistic interests. Clerical interests are also reasonably high with markedly low interests being obtained only in computational and musical areas. Women physicians and trained nurses show rather similar mean scores and standard deviations on the Kuder test.

These data presumably have been obtained from nurses involved in general duty nursing and do not include nurses in the specialty of public health nursing.

Therefore, in undertaking a study of the vocational interest patterns of public health nurses, the only direct comparison we can make can be between the obtained results and those for women in a variety of other occupations and perhaps more meaningfully in relationship to what is presumed to exist as the core group of interests underlying public health nursing.

Wensley (10), in her book *Community and Public Health Nursing,* says:

> The public health nurse bears a resemblance to the doctor in her interest in medicine; to the bed-side nurse in her basic training; to the medical social worker in her knowledge of the community and its medical resources; to the family case worker in having a base in the community and an interest in the family as the fundamental unit of practice. The difference, which is constant for all of these, is her interest in prevention, through which she gets into action earlier than the others, often before the disturbances of the family equilibrium have taken the form of illness.

Underlying this statement we see expressed as the prevailing opinion the fact that the public health nurse will differ rather markedly from other areas of nursing since her function and her rôle is in itself a complex gestalt (1). This point of view has received considerable attention and is the prevalent feeling within public health areas (3, 9). From this statement we would normally expect that the public health nurse would have a strong interest in scientific areas as well as very strong interests in social service areas. In terms of her direct interpersonal relationships in preventive health we would expect her to have rather high persuasive interests, since this would be a psychological attribute of a teaching rôle and function. Thus it is against such a hypothetical and prevailing perspective on public health nursing that we can critically examine the actual nature of public health nurses' vocational interests.

D. RESULTS

Table 1 contains the raw scores, means, standard deviations, and percentile ranks on the Kuder Preference Record for the total public health nursing group involved in this study of occupational interests. Inspectional examination of this data indicates that from high score to low score the following hierarchy on the Kuder scales is indicated: artistic, social service, mechanical, scientific, musical, persuasive, literary, computational, and clerical. The patterning in general does not appear to be extremely variant on objective analysis, nor are any scales except the clerical noticeably low from a statistical point of view alone. A more meaningful interpretation of these findings appears to be reflected in Tables 2 and 3, which show the percentile ranks and mean scores for the public health nursing group in relationship to 11 other groups of women for whom normative data is available with respect to the Kuder Preference Record. The data with which the public health nursing group is compared has been obtained from the revised manual for the Kuder Preference Record, Form *B*. The 11 groups with which the nurses are compared are: trained nurses, physicians, occupational therapists, laboratory technicians, hospital dieticians, religious workers, personnel clerks, high school teachers of home economics, home demonstration agents, a base group of 1,429 adult women, and a group of college freshmen. The sampling which was used for a comparative analysis and is referred to on a comparative basis throughout this study was selected because of its inclusion of many of the healing arts and sciences as well as related social and welfare occupations in which women are predominantly employed. This comparison with respect to other professions open to large numbers of professional women offers us a means for a more direct analysis of vocational interest patterns with respect to the kind of work activity that these women may be involved in. The college freshmen and base group of adult women offer a generalized and more random segment of the female population for similar comparisons.

TABLE 2

PERCENTILE RANKS ON THE KUDER TEST FOR PUBLIC HEALTH NURSES AND ELEVEN OTHER GROUPS OF WOMEN

	Mec.	Com.	Sci.	Per.	Art	Lit.	Mus.	Soc. Ser.	Cler.
Public Health Nurses	63	25	55	48	75	45	55	63	8
Trained Nurses	59	42	72	30	57	49	53	71	23
Physicians	77	49	87	24	62	54	45	66	9
Occupational Therapists	87	32	57	26	80	46	60	56	14
Laboratory Technicians	84	55	92	26	58	32	53	36	24
Hospital Dieticians	56	71	86	41	50	51	53	47	28
Religious Workers	37	22	34	38	50	66	53	93	32
Personnel Clerks	51	31	54	81	66	66	53	56	31
H. S. Teachers/Home Ec.	65	45	60	41	64	51	45	47	28
Home Dem. Agents	61	35	41	59	64	27	55	71	23
Base Group Adult Women	56	51	57	53	53	54	53	47	47
College Freshmen	37	41	49	68	43	66	68	49	34

Utilizing the data from Table 2, which reports the percentile ranks for each scale of the Kuder for the public health nursing group and the 11 compared groups, we find that a scale-by-scale analysis reveals the over-all trend for the public health nursing pattern.

TABLE 3
MEAN SCORES ON THE KUDER TEST FOR PUBLIC HEALTH NURSES AND 11 OTHER GROUPS OF WOMEN

	Mec.	Com.	Sci.	Per.	Art	Lit.	Mus.	Soc. Ser.	Cler.
Public Health Nurses	56.35	24.32	53.89	59.85	64.51	49.45	23.32	88.82	39.11
Trained Nurses	53.52	28.53	60.41	52.80	53.77	50.30	21.93	93.07	50.02
Female Physicians	62.83	31.41	71.32	49.79	56.69	53.21	20.17	90.62	40.38
Occupational Therapists	73.29	26.09	55.21	51.09	67.94	48.89	24.11	86.03	43.86
Laboratory Technicians	69.26	33.03	75.29	51.34	55.12	44.36	22.03	75.91	50.71
Hospital Dieticians	53.00	36.61	63.16	57.90	51.00	52.23	22.71	80.55	53.13
Religious Workers	45.23	22.55	46.68	56.74	51.10	57.61	23.19	108.87	55.23
Personnel Clerks	51.07	26.00	54.36	74.95	59.36	58.02	22.91	86.36	53.55
H. S. Teachers/Home Ec.	57.25	30.33	55.66	58.21	58.20	50.89	19.89	81.17	53.39
Home Dem. Agents	54.50	27.00	49.12	64.48	57.93	42.31	22.67	92.64	49.74
Base Group Adult Women	52.67	31.75	54.70	61.50	53.43	52.60	21.47	81.42	62.31
Univ. of Wis. Freshmen	45.29	28.52	52.09	68.44	48.87	57.91	25.85	82.23	56.05

1. *Mechanical Interests*

The public health nursing data with respect to interests in mechanical areas is reasonably high, standing at the 63rd percentile. Generally, this reflects a somewhat greater than average interest in mechanical aspects of job function, and when we compare it with the 11 occupational groups used in this study we find that public health nurses have more interest in mechanical activities than do trained nurses, hospital dieticians, religious workers, personnel clerks, home demonstration agents, the base group of adult women, and college freshmen. On the other hand, the following professional groups were found to have even stronger mechanical interest than the public health nursing group: physicians, occupational therapists, laboratory technicians, and high school teachers of home economics. Thus, while the actual mechanical interest score appears reasonably high for the public health nursing group, it would appear to be about average with respect to other groups of professional women and women in general. We might assume from this data that public health nurses have a somewhat stronger interest in mechanical areas than women generally, markedly more so than college freshmen, and about average for women in the healing arts and sciences.

2. *Computational Interests*

On this scale public health nurses reflect a rather low interest in computational activities. Their mean score places them in the lower 25 per cent of the general population norms. On a comparative basis we find that all of the female groups used in this study for comparative analysis have stronger interests in computational activities than do public health nurses, with the one exception of religious workers, who have an insignificantly lower Kuder score in this category. With particular respect to those occupations involving health and education, as well as women in general and college women in particular, public health nurses appear to have much less interest in computational activities than all of the others. Thus it would seem that computational interests are negatively related to public health nursing interests generally, and is not one of the occupational interest determinants of this group.

3. *Scientific Interests*

This is a scale which, on face value, would appear to be one of the significant ones for all of the healing arts and sciences and for nursing in particular. The public health nurse percentile rank on this scale was 55, which, in addition to its statistical average implication, is slightly lower than that for the base group of adult women and somewhat higher than that for college freshmen. On the other hand, we find that the following occupational groups have higher scientific interests: physicians, occupational therapists, hospital dieticians, and high school teachers of home economics. From the vantage point of significant deviation it would appear that trained nurses, physicians, laboratory technicians, and hospital dieticians deviate most significantly from the public health nursing norms and all of these groups reflect greater interest in science and scientific areas than do the public health nurses reported upon here. This would appear to be of some interest since the direct comparisons are made with women in health and healing arts fields and in this respect it would seem that public health nurses vary considerably from their medical and para-medical colleagues in the degree to which scientific interests and attitudes structure their total professional orientation.

4. *Persuasive Interests*

On the persuasive interests scale the public health nursing percentile rank was 48. This was somewhat lower than the base group of adult women and considerably lower than the mean percentile for college freshmen. On the other hand, the public health nursing group had significantly higher persuasive interests than trained nurses, physicians, occupational therapists, laboratory technicians, hospital dieticians, religious workers, and high school teachers of home economics. Although the percentile rank in itself is not exceptionally high, its meaning becomes clear when compared with other groups of women in a variety of occupations and particularly with respect to those in occupations dealing with human relations and healing arts and sciences. The public health nurse seems to have a much greater interest in persuasive rôle-taking and rôle-playing attitudes in relation to occupational activities than do most of the vocational groups with which she has been compared.

5. *Artistic Interests*

The artistic interest scale in itself would not appear to have any direct implication for public health nursing or even of related occupational groups.

It is of some interest to note that the public health nursing group obtained its highest mean score on the artistic interest scale. A percentile rank of 75 exceeds all of the occupational groups with the exception of the occupational therapist, who has an only slightly higher scale than the public health nurse. It might be expected that the occupational therapist would score high here in terms of her actual work activities, and it is somewhat a surprise that the public health nurse scores as highly as she does and perhaps more significantly so that she exceeds all other groups of women, including the base group of adult women and the college freshmen as well as the group of women in the medical and para-medical fields. Again we see that the interest pattern on the Kuder for the public health nurse seems to be decidedly different than that for other women in medical, para-medical, and certain scientific areas.

6. *Literary Interests*

This interest scale was also one whose significance in the nursing profession would appear to be minimal. The score obtained by public health nurses here is about average on general norms, somewhat below that of the base group of adult women generally, and rather markedly below that of college freshmen. It is slightly below that for trained nurses, it is more markedly below that for physicians, only slightly below that of occupational therapists, somewhat below hospital dieticians, rather markedly below religious workers, below personnel clerks, somewhat below high school teachers of home economics, and considerably higher than laboratory technicians and home demonstration agents. Generally, although the literary interests of public health nurses would appear to be within an average range when compared with women in general and in specific professional occupations, it would appear to be somewhat lower than most other professional women.

7. *Musical Interests*

The musical interests of public health nurses are in general very similar to those for other professional women and, apart from college freshmen, who would appear to have the strongest interest in musical areas, there is no significant variation among any of the occupational groups studied here.

8. *Social Service Interests*

This is a scale which would appear to be of singular significance in all human relations occupations. The public health nursing percentile rank is reasonably high and considerably exceeds the mean score for the base group of adult women and college freshmen. It is of some note that trained nurses have a rather higher score in social service than do public health nurses. Physicians also have a higher score in social service than do public health nurses. Religious workers and home demonstration agents appear to be considerably higher in this area. On the other hand, occupational therapists, hospital dieticians, personnel clerks, and high school teachers of home economics, and laboratory technicians appear to have less interest in social service than do public health nurses. Generally, public health nurses' interest in social service is reasonably high. It is very much lower than that of religious workers and is somewhat lower than that of trained nurses and physicians.

9. *Clerical Interests*

The clerical interest scale for public health nurses was very much lower than for any other group of women studied, including the base group of adult women and college freshmen. There is no great variation among occupational groups on this scale with the exception of physicians, who have the next lowest and very similar score to public health nurses. Generally, the base group of adult women have stronger clerical interests than do professional women, but of all the professional groups, the public health nurse has the lowest interest in clerical activities. They are approximated in this regard only by physicians.

The results from the data recorded in Tables 1, 2, and 3 generally reflect a trend for the vocational interest patterns of public health nurses to differ more from women in human relations, medical, and para-medical professions, than from adult women in general. The very question of the homogeneity of vocational interest patterns for groups within any occupation is still a subject of much question. The rationale of occupational choice and the determinants of occupational interests would lead to the assumption that considerable variability would have to be expected, yet this variability should be somewhat less than that to be anticipated in a more generalized population. Table 4 reveals a rank order index of variability on the Kuder Preference Record, which was based on an analysis of variability on this test for the following groups of women: public health nurses, physicians, journalists, artists, occupational therapists, librarians, registered nurses, laboratory technicians, religious workers, a base group of adult women, and col-

TABLE 4
A RANK ORDER INDEX OF VARIABILITY ON THE KUDER TEST FOR PUBLIC HEALTH NURSES AND SOME COMPARED OCCUPATIONAL GROUPS

Public Health Nurses	10
Female Physicians	12
Journalists	14
Artists	13
Occupational Therapists	12
Librarians	14
Registered Nurses	13
Lab. Technicians	15
Religious Workers	13
Base Group Adult Women	15
Female College Freshmen	16

lege students. All of the data are from the norms in the revised manual for the Kuder Preference Record. The standard deviations from each of the nine scales of the Kuder were computed and on the basis of the data a mean index of variability was arrived at which is a sum of the means of the standard deviations. Although a simple and in fact somewhat arbitrary rule of variability, it nevertheless does show within limits, to what extent the data gathered in our study of public health nurses assumes equal, less, or more variability than the data already gathered in the study of many other women in the occupations mentioned above. Table 4 indicates that the index of deviation variability for public health nurses is 10. This is of some significance in that we note it is lower than for any of the other groups of women studied, both those in specific occupations and the base group of adult women and the base group of college freshmen. When we consider the base group of adult women we find the index of variability to be 15. This is very closely approximated by the college freshmen with an index of 16. These are undifferentiated women with respect to occupational choice or interests. On the other hand, we find that when women in specific occupations are studied, with the exception of the laboratory technician, all of them have lower indices of variability. In view of the fact that the index of variability in itself is based on a measure of variability, namely the standard deviation, a differentiation of more than one point on this index scale would assume some significance and certainly be worthy of further speculation and possible interpretation. When compared with the base group index of 15, the public health nursing index of 10 is very sharply more homogeneous. It is also considerably more homogeneous than registered nurses, journalists, artists, occupational therapists, and religious workers. Physicians, with a variability index of 12, come closest to the homogeneity of the public health nurse. From a consideration of this data it would seem that generally speaking the Kuder Preference patterns which have been obtained for public health nurses assume a degree of homogeneity somewhat greater than that obtained in other studies of women in specific occupations, and a very considerably greater degree of homogeneity than for women in general. This fact would suggest that there are apparently very real determinants behind the selection of public health nursing as an area of specialization and that the variations within the patterning of the Kuder already noted in comparison with other medical, paramedical, and human relations fields assumes more significance since this differentiation appears to be a reasonably consistent one and reflective of more of the total group than segments of it. The problem of relative homogeneity is probably of more significance in comparative vocational studies than of absolute homogeneity from a statistical point of view. Occupational choice and the determinants of vocational interests would appear to have as many comparative or relative determinants as they would absolute determinants.

In Table 5 a further comparative analysis of public health nursing patterns on the Kuder is made with respect to the highs and lows for each scale in relation to already existing data for women in specific occupations. What has been done has been to take the public health nursing mean percentile rank and compare it to the mean percentile rank of an occupational group of women who come closest to it and then to compare this same percentile rank with the highest and lowest percentile ranks for occupational groups of women which are available in the normative literature. A scale-by-scale analysis is thus presented in Table 5.

With respect to mechanical interests we find that the group closest to the public health nurse is the high school teacher of home economics. Here the public health nursing and teaching occupations are very close. The highest score in this area is found among laboratory technicians and the lowest among high school teachers of English. The nurse would appear to stand between both of these extremes.

With respect to computational interests, musicians and music teachers would appear to have similar interests in this category as do public health nurses, all of whom have very low scores in this area and compare with a highest score of 90 by high school teachers of mathematics and the lowest of 15 by artists and art teachers.

With respect to scientific interests, public health nurses and personnel clerks have an equated score in this area. Their percentile ranks of 55 compare with 93 for the laboratory technicians, which is the highest, and 24 for the artist and art teacher, which is the lowest.

On the persuasive scale the public health nurse and the high school teacher of languages have similar ranks. The highest score is obtained by women in retail buyer occupations and the lowest by female physicians.

Artistic interests for public health nurses are very similar to that of librarians and considerably lower than the highest interest scores obtained by artists and art teachers and considerably higher than the lowest, obtained by sales clerks.

The literary interests of public health nurses are similar to those of high school teachers of commercial subjects, considerably lower than those of women journalists, and somewhat higher than the lowest scale, which is noted for women IBM operators.

TABLE 5

KUDER SCALE COMPARISONS FOR PUBLIC HEALTH NURSES AND SIMILAR AS WELL AS VARIANT OCCUPATIONAL GROUPS OF WOMEN

	Mec.	Com.	Sci.	Per.	Art	Lit.	Mus.	Soc. Ser.	Cler.
P. H. N.	63	25	55	48	75	45	55	63	8
Closest Occupational Norm	H. S. Tchrs Home Econ.	Musicians & Mus. Tchrs	Personnel Clerks	H. S. Tchrs Languages	Librarians	H. S. Tchrs Comm. Subs.	Statis Clerks	H. S. Tchrs Soc. Science	Physicians
Percentile	65	28	55	48	73	45	55	63	10
Highest Occupational Norm	Lab. Technicians	H. S. Tchrs Mathematics	Lab. Technicians	Retail Buyers	Artists & Art Tchrs	Journalists	Musicians & Mus. Tchrs	Religious Workers	Bkkpprs.
Percentile	84	90	93	94	97	83	97	93	69
Lowest Occupational Norm	H. S. Tchrs English	Artists & Art Tchrs	Artists & Art Tchrs	Physicians	Sales Clerks	I.B.M. Operators	H. S. Tchrs Soc. Studies	H. S. Tchrs Comm. Subs.	Physicians
Percentile	30	15	24	25	26	30	29	17	10

The musical interests of public health nurses are similar to those of statistical clerks, considerably lower than those of musicians and music teachers, who have the highest scale in this area, and considerably higher than the lowest scale, to be found among high school teachers of social studies.

The social service scale for public health nurses is the same as that for high school teachers of social science. This is considerably lower than the highest scale for women, which is to be found among religious workers, and considerably higher than the lowest, which is to be found for high school teachers of commercial subjects.

The clerical interest scale indicates that public health nurses and physicians have similar scales and both are uniformly low, considerably lower than the highest, which is to be found among women bookkeepers.

This comparative occupational picture of public health nursing vocational interests indicates that the public health nurse generally approaches neither the highest nor the lowest groups on any of the nine scales of the Kuder. There is no order or consistency with regard to those groups with which she comes closest but it is of some interest to note that of the nine scales five are closest to groups who are involved in teaching occupations. This would appear to be the only significant comparison noted from the point of view of occupational similarity. Again we find that there is no evidence that the public health nurse has interests markedly similar either to the trained nurse, herself, or to other women involved in medical or para-medical services. Tables 6 and 7 represent a statistical index of interest based on comparative occupational data. In these tables we are dealing with rank rated scores rather than with the original raw scores or percentile ranks. A rated score on this measure of relative interest is based on the number of women's occupational groups that are exceeded on the basis of raw score. Thus, each of the compared groups of women present in Tables 6 and 7 have been given a rated score based on how many of the eleven groups of women in various occupations that they exceed on each compared scale with respect to the original mean score. The groups we are directly concerned with are those in the medical and para-medical fields and include the public health nurse, the physician, the registered nurse, the occupational therapist, the laboratory technician, and the hospital dietician. The base group of adult women are also used for direct comparison against a general norm. Each one of these groups was compared with the mean scores for women in public health nursing, registered nursing, medicine, occupational therapy, laboratory technology, hospital dietetics, religious workers, personnel clerks, high school teachers of home economics, home demonstration agents, college freshmen, and a base group of adult women. Thus allowing for the removal of one group in direct comparison with the others, the highest score on a relative basis that any one occupational group could achieve would be 11. This would mean that that group exceeded all other 11 groups of women with respect to that interest. This would be a relative measure since it would be based on a rank order rather than on an absolute measurement index. A low of zero would reflect the fact that all of the other groups exceeded this group. Thus, on Tables 6 and 7 we have rank order rated index scores for six medical and para-medical groups of women and for the base group of adult women in relation to the mechanical, computational, scientific, persuasive, social service, and clerical interests; and on Table 7 with respect to a combination of scientific and social service interests, mechanical and scientific, and mechanical and social service interests. This measure permits us to make a direct comparison based on the relative interest that each group displays within the categories of the Kuder which appear to have face value significance in relation to the activities involved in the occupation.

TABLE 6

RANK ORDER RATED INDICES OF MECHANICAL, COMPUTATIONAL, SCIENTIFIC, PERSUASIVE, SOCIAL SERVICE, AND CLERICAL INTERESTS FOR A GROUP OF PUBLIC HEALTH NURSES

	Mec.	Com.	Sci.	Per.	Soc. Ser.	Cler.
Public Health Nurses	7	1	3	7	7	0
Female Physicians	9	8	10	0	8	1
Registered Nurses	4	6	8	3	10	4
Occupational Therapists	11	3	6	1	5	2
Lab. Technicians	10	10	11	2	0	4
Hospital Dieticians	4	11	9	5	1	6
Base Group Adult Women	3	8	5	8	3	11

TABLE 7

RANK ORDER RATED INDICES OF SCIENTIFIC-SOCIAL, MECHANICAL-SCIENTIFIC, AND MECHANICAL-SOCIAL INTERESTS FOR A GROUP OF PUBLIC HEALTH NURSES

	Sci.-Soc.	Mec.-Sci.	Mec.-Soc.
Public Health Nurses	10	10	14
Female Physicians	18	19	17
Registered Nurses	18	12	14
Occupational Therapists	11	17	16
Lab. Technicians	11	21	10
Hospital Dieticians	10	13	5
Base Group Adult Women	8	8	6

With respect to mechanical interests we find that the public health nurse is exceeded by the physician, by the occupational therapist, and by the laboratory technician. She has considerably higher mechanical interests than the registered nurse, than the hospital dietician, and the base group of women. The weighted interest score of seven achieved by the public health nurse indicates that her mechanical interests are, in comparison with other groups of women, generally higher than most, but not excessively higher than the group in the medical and para-medical fields, several of whom exceed public health nursing interest by a considerable degree.

The computational interests of public health nurses in terms of a comparative index reveal essentially the results obtained by direct analysis of the computational interest scale, that is, a very low index of interest. The public health nurse has a significantly lower interest in computational activities than any of the other groups involved in medical and para-medical work with the exception of the occupational therapist. The public health nurse also has a significantly low interest in computational activities when compared with adult women in general.

The interest index for scientific interests reveals that the public health nurse has a lower index of interest in scientific areas than do adult women in general and significantly lower than women in medical and allied fields. The public health nurse index of *three* compares with the *11* for laboratory technician and *10* for physician. Even the occupational therapist, who generally departs from the patterning of the para-medical and medical groups, has an index twice as large as the public health nurse.

On the persuasive scale the public health nurse has a higher interest index than all of the other women in medical and related fields and has an index of persuasive interest almost as high as women in general. The sharpest contrast appears between the public health nurse index of *seven* and the physician of *zero*.

On the social service scale the public health nursing index is generally high but is exceeded by the physician and by the registered nurse. It is, however, considerably higher than adult women in general and markedly higher than hospital dieticians, laboratory technicians, and occupational therapists.

As noted elsewhere, the clerical interests of public health nurses are unusually low and are the lowest by far of all groups of women that have been studied up to this time with the Kuder Preference Record.

Table 7 combines various scales of the Kuder Preference Record into three major categories: (*a*) Scientific-social service areas, (*b*) Mechanical-scientific interest areas, and (*c*) Mechanical-social service areas. With respect to a combination of scientific and social service interests we find that the public health nurse has a somewhat higher interest index than adult women in general but considerably lower than physicians, nurses, and about the same as occupational therapists, hospital dieticians, and laboratory technicians. Perhaps the major reflection here is the markedly lower rating with respect to relative interest in scientific and social service areas for the public health nurse than for the registered nurse or physician.

With respect to mechanical-scientific interests the public health nurse has a lower index of interest than any of the groups of women with whom she is compared in Table 7 and has only a somewhat slightly higher index of interest than adult women in general. Her interest in mechanical-scientific areas is markedly lower than that of the physician, than that of the occupational therapist, than that of the laboratory technician, and than that of the hospital dietician. It is also somewhat lower than that of the trained nurse.

In examining the mechanical-social service interests of public health nurses we find that their interest in this area is higher than the laboratory technician, higher than the hospital dietician, and much higher than the base group of adult women. It is considerably lower than the occupational therapist, the same as the registered nurse, and lower than the physician.

TABLE 8

RANK ORDER RATED INDEX OF SCIENTIFIC-HUMAN RELATIONS INTERESTS FOR A GROUP OF PUBLIC HEALTH NURSES

Public Health Nurses	18
Female Physicians	26
Registered Nurses	27
Occupational Therapists	15
Lab. Technicians	23
Hospital Dieticians	26
Base Group Adult Women	24

Table 8 reflects a measure of interest in what has been termed scientific human relations based upon the relative interest index scores for the computational, scientific, persuasive, and social service scales of the Kuder. This interest index score is a cumulative one based on the comparative rank scaling technique already described for these four scales. An analysis of the data which is compiled in Table 8 indicates that with respect to this measure of scientific human relations interests the public health nurse has considerably less interest in this area than does the base group of adult women in general. She has markedly less interest in scientific human relations than does the physician, the registered nurse, the laboratory technician, and the hospital dietician. Thus, her interest in scientific human relations appears to be significantly lower than most of the women in medical and allied fields with whom she has been compared in this study, and even lower than the base group of adult women. The scientific human relations score for the public health nurse exceeds only that of the occupational therapist.

Since one of the underlying assumptions in the comparative study and analysis of vocational interest patterns has been that the interest of an individual or a group assumes perhaps greater significance in relation to others than in its absolute measure in itself, a rank order correlational approach was undertaken in the treatment of the public health nursing data obtained from the Kuder Preference Record. Rank order correlations between the scales of the Kuder for public health nurses were obtained for them and college freshmen, the base group of adult women, artists and art teachers, laboratory technicians, hospital dieticians, religious workers, occupational therapists, trained nurses, female social workers, male social workers, and female physicians. With the exception of the male social workers, all of the groups were women. The use of rank order correlational techniques appears to be useful for the clinical and statistical examination of the relative interests of public health nurses in regard to other groups of women and with regard to one group of men.

TABLE 9

RANK ORDER CORRELATIONS BETWEEN A GROUP OF PUBLIC HEALTH NURSES, 10 OCCUPATIONAL GROUPS OF WOMEN, AND ONE MALE OCCUPATIONAL GROUP ON THE KUDER PREFERENCE RECORD

Occupation	Kuder Rho With P.H.N. Group
Female College Freshmen	.64
Kuder Base Group Adult Women	.67
Artists & Art Teachers	.93
Laboratory Technicians	.84
Hospital Dieticians	.64
Religious Workers	.62
Occupational Therapists	.93
Trained Nurses	.89
Female Social Workers	.79
Male Social Workers	.66
Female Physicians	.80

Table 9 contains the inter-correlations which were obtained in this study. The interpretation of these correlations requires an examination of some data with regard to the expected or probability of expected correlations. Since we are dealing with only nine scales and since these scales in themselves represent an interest in basic areas of work activity rather than in occupations per se, there is, because of the inherent nature of these areas, strong possibility that we will almost always get positive correlations of reasonably high degree when we compare varying groups. In other words, inclusion of musical, literary, and clerical scales in themselves in relationship to others have often less occupational significance than many of the other scales. Therefore, the degree to which we find differences among groups will be in terms of a relative rank rather than an absolute measure. Thus, for example, when the base group of over 1,000 women was correlated on a rank order basis with the base group of over 1,000 men a positive correlation of +.64 was obtained. This might be used as a base measure for critical interpretation. Thus, significant correlations between occupational groups might be felt to exist only where the correlation exceeded .64 *significantly*. In Table 9 we find that with respect to positive correlations there appear to be only three which have any significance according to the standards established here. The highest correlation between the public health nursing pattern and other groups was found with respect to two occupations. A correlation of .93 was obtained between the public health nurse pattern and those for artists and art teachers and for occupational therapists. A reasonably high correlation of .89 was obtained between trained nurses and public health nurses and a correlation of .84 between public health nurses and laboratory technicians was obtained. Low correlations, which in view of the technique which was employed would refer to vastly different patterning, were obtained between public health nurses and college freshmen, the base group of adult women, religious workers, and social workers, with the greatest difference being between male social workers rather than female social workers.

The two most significant correlations which were obtained were between the public health nurse and two occupational groups displaying very high aesthetic interests.

E. Psychological Discussion

This study of the vocational interest patterns of public health nurses has produced one factor not previously encountered in the related studies of public health nurses in relation to mental hygiene education and function. This is the factor of homogeneity. On tests of intelligence, personal values, conservatism-radicalism, and attitudes toward in-service mental health education, the public health nurse population was found to be highly variable and decidedly heterogeneous (2, 4, 5). With respect to vocational interests, public health nurses appear not only to be contrastingly homogeneous but relatively more homogeneous than many other groups of women in medical and para-medical occupations.

Thus at this point in our study of public health nurses we find that despite measurable heterogeneity in verbal intelligence and aspects of personality dynamics, there appear to be similar and possibly constant psychological determinants for their interest in and choice of public health as a nursing specialty.

Strongly expressed interest in aesthetic and persuasive activities dominates the Kuder pattern for public health nurses and accounts for much of the "pattern" variations from physicians, registered nurses, hospital dieticians, and laboratory technicians, all of whom are in "conceptually" allied areas of work. Along with this, the public health nurse reflects less interest in scientific and scientific-human relations areas than do these allied groups of women.

On the other hand, very high interest in persuasive areas in addition to strong interests in aesthetic activities as well as more than average interest in social service functions imply that public health nurses have interests in relationships with people, though somewhat differently structured than related medical and allied groups. The very high combination of persuasive and aesthetic interests suggests a fundamental interest in interpersonal relationships related more to structure, design, and to influence behavior and motivation than to diagnose, treat, or do research in the more fundamental scientific sense.

Such implications can be ascertained only through further study, but the findings here strongly suggest that many of the determinants and motivations for the selection of public health nursing as a specialty may be more related to a rejection of classical nursing service than to an extension of such service into public health areas. Thus, while public health nurses generally may incorporate all of the orthodox nursing services into their professional function, they do so within a totally different frame of reference, with different objectives and possibly with different attitudes as well as self concepts of their rôle and purpose. There is in this pattern of motivation a suggestion that public health nurses reject activities that are "process" centered or activity centered for those that are structurally or patient centered.

Interest in job function would tend to be on this basis strongly related to the degree to which the public health nurse can assume responsibility and follow through on a gestalt basis. Thus, if mental hygiene education or function adds to her rôle a "technological" rather than a "purposive" addition she is more likely to show less interest and identification with it until it becomes "purposive" or more complete as a whole rather than a segmental function.

Much of the above interpretation remains to be studied and clarified through further experimental investigation, but from this study and analysis of the vocational interest patterns of public health nurses there is some evidence that the degree to which a function, whether it be service or education, is accepted and integrated into the public health nurse's total professional frame of reference may depend more on a departure from "segmental," traditional nursing technique and its closer proximity to relatively autonomous, holistic incorporation as a whole rather than partial occupational activity. Thus many of the actual occupational interests of public health nurses would appear to be in "activity terminology" sharply contrasted both from other nurses and related medical personnel.

The interests which have been expressed here by this group of public health nurses suggest that their interest in public health involves much more of a concern with planning, surveying, and educating functions than with technical, medical, or allied services. The latter kind of services can optimally be segments of professional service to patients whereas the former assume a much more complete and relatively autonomous area of activity for the public health nurse.

F. Public Health Nursing Discussion

These findings seem to confirm the general opinion that public health nurses differ markedly from nurses in other areas of nursing. The prevailing opinion as to how they differ has been stated in many ways, but in general it seems to be that public health nurses would have a greater interest in the sciences and in interpersonal relations than do nurses in other areas. That public health nurses tend to have relatively less interest in scientific and scientific-human relations areas than do physicians and trained nurses as a whole, seems contrary to prevailing opinions. The public health nurse has been said to bear a resemblance to the doctor, which she does, but not so much in her interest in medicine or scientific interest, as in the professional rôle being accredited to her on the basis of her relationship to the family and community. Her basic training may have been the same as the bedside nurse, but as a group her scientific interest would appear to be less intensive, with less concept of dedication to service, and of a more generalized and educative nature. She is less a technician in her basic interest, and her artistic interests indicate a concern with the structure and fitness of things rather than a more critical cognitive concern. These interests would appear to have a relation to the dearth of research activities in public health nursing. The nurse is recognized as being in a strategic position to do research, and contribute to knowledge of family and community relationships. That she has been slow to use this opportunity to collect and analyze data may relate to her particular vocational interest pattern.

Since the public health nurse has a teaching function in preventive programs of health it was expected that she might have higher persuasive interests than many other women in allied areas. This study bears out this supposition and relates to the factors discussed above. The public health nurse seems to have moved away from the more technical nursing skills into teaching and counseling activities with many vocational interests similar to the teaching occupations.

It remains to be seen whether as has been stated "that nurses are being educated away from the bedside," or that there is within the profession a group who seek to move in the direction of a public health counseling relationship combining a nursing-teaching function.

G. CONCLUSIONS

1. Vocational interest patterns of public health nurses appear to be relatively homogeneous and can be differentiated from vocational interest patterns of women in the major medical and para-medical fields relating to public health nursing.

2. Public health nurses tend to have relatively less interest in scientific and scientific-human relations areas than do physicians, trained nurses, laboratory technicians, and hospital dieticians.

3. It would also seem that with respect to scientific-human relations interests the public health nurse as studied here has less interest in this area than do adult women in general.

4. Public health nurses appear to have extremely low interests in computational and clerical activities which differentiate them sharply from adult women in general and from many of the occupational groups involved in medical and allied areas of service.

5. The public health nurse appears to have a relatively higher interest in persuasive activities than do most of the women in professional fields allied to public health nursing.

6. The highest Kuder Preference scale for the public health nursing population was the artistic one, which was significantly higher than all of the groups of medical and para-medical occupations with which she was compared. Public health nurses also exceeded the base group of adult women and college freshmen on this scale.

7. Rank order correlations revealed highest correlations between public health nursing and artists, art teachers, and occupational therapists.

8. The lowest rank order correlations were obtained between public health nurses and the base group of adult women, college freshmen, and religious and social workers.

9. Although the scale-by-scale analysis of the Kuder Preference Record for public health nurses assumes no great intra-test variability, the patterning obtained from this group of nurses does appear to represent distinct occupational differences when compared with other professional groups of women.

10. The nature of the differences in vocational interests between public health nurses and women in allied fields of work appears on the surface to be somewhat of a contradiction to what is usually considered to be the nature of motivation within public health nursing.

11. The results of this study of vocational interests among public health nurses seem to indicate a range of occupational interests considerably different from that which is presumed to exist and should be re-evaluated in relationship to professional aspirations, administrative procedures, and in-service educational practices.

12. Public health nursing as an occupational specialty appears on the basis of vocational interests to possess certain unique psychological characteristics which indicate a need for further study of the total psychological determinants of public health nursing as a profession.

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SOME CHANGING ASPECTS OF THE SELF-CONCEPT OF PUBESCENT MALES*

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A. INTRODUCTION

Current literature on psychological theory utilizes the term *self-concept* as one important aspect of personality. It was the purpose of this study to observe any change occurring in the "concept of the self" during the period of rapid physiological change in early adolescence. Physiological phase classifications determined by appraisal of pubic hair development in 12-, 13-, 14-, and 15-year-old males categorized the youth studied. These physiological phase classifications served as the indicator of growth with which aspects of the self-concept were compared in terms of developmental progress.

The importance of the physical changes accompanying the adolescent transition is rarely minimized, even by writers whose particular emphasis and training are in the social-psychological realm. George H. Mead (1934), some two decades ago, described the development of the self-concept as emerging directly from the behavior of others toward the individual and indirectly from the physical and other attributes of the individual. Horrocks very aptly describes the importance of the physical changes of adolescence by stating that the changes of adolescence "are often startling and even disquieting . . . it is usually difficult to adjust to the new physical actuality as well as to the new physical self-concept which that actuality involves" (1951, pp. 258-259).

A process of adjustment is implied by Horrocks which suggests personality changes occurring concomitantly with physical changes. Zachary (1940) referred to the body as the "symbol of the self." Anna Freud (1935) attributes many of the adolescent's anxieties and uncertainties to a resurging sexuality of adolescence implying a biological basis for personality changes; however, she fails to explain the exact nature of this relationship in terms of the psychological concepts of the times.

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On examining the psychological mechanism of the self-concept in a perspective of total growth it would appear that the physical changes of adolescence, no less than the rapid changes of infancy, will be reflected in the individual's behavior as he becomes aware of new abilities and new possibilities within himself, particularly as he relates himself to others. It is this viewpoint around which the study was developed. Others have made methodologically similar approaches but with little emphasis on the adolescent's own feelings about himself (Dimock, 1937; Stone and Barker, 1939; Jones and Bayley, 1950; Sollenberger, 1940).

B. Use of the Term Self-Concept

The present discussion does not propose to eliminate the ambiguities prevalent in the use of the term self-concept but rather to elaborate on its use in this report. The responses made by the subjects were evaluated in terms of their projective qualities of the self. In making these appraisals it is to be realized that the facility of complete self-realization does not occur spontaneously in childhood, but according to most researchers on the topic, develops slowly, by gradual changes. Gardner Murphy (1947, p. 343) explains the genesis of selfhood by three developmental levels similar to the process of individuation evidenced in maturation and motor learning. Piaget (1932) has also postulated levels, or stages, of moral development suggesting that the perception of the relation of one's self to the whole society does not occur until early adolescence. Jersild's definition of the "self" is "a composite of thoughts and feelings which constitute a person's awareness of his individual existence, his conception of who and what he is" (1952, p. 9). Recognizing the dynamic nature of "these thoughts and feelings," their reflection or expression in one's responses to his stimulus world seems inevitable and therefore appears accessible to our commonly used projective techniques.

Two assumptions of major concern emerge from this discussion. First, the self-concept, existing as a part of the totality commonly termed personality, is mirrored or projected in the behavior or responses of the individual. Second, this self-concept changes, gradually taking on the characteristics of the adult rôle in our society as a result of growth processes and learning experiences with major changes taking place during the rapid growth period of puberty. A description of these changes in self-concept and their relationship to the pubertal growth processes constitutes the problem area of the present study.

The instruments for measuring aspects of the self-concept were developed from instruments and techniques commonly used in personality appraisal. These were: (*a*) an adaptation of the *Vineland Social Maturity Scale,* (*b*) human figure drawings, and (*c*) paragraph completion items relating to heterosexual development and emancipation from parents.

C. Choice of Growth Indicator

To determine the effects of the rapid physical changes of puberty on the adolescent's self-concept the writers were faced with the problem of selecting the areas of growth in which measures of physical changes of puberty would be made. Use of maximum increments of growth as described by Shuttleworth (1937) was not practical due to the spotty growth records available for the subjects. Measures of maturity indicated by bone growth, while excellent when used as an indicator of total growth, would not appear to be of psychological importance to the individual as bone growth has no particular cultural or social value. It seemed evident that the growth measures to be used would necessarily be those for which a definite end point (or maturity) was known and towards which progress could be readily estimated. At the same time it was realized that certain areas of growth (particularly sex development) were of vast importance in the prestige system of boys and girls.

The growth processes of most importance psychologically to the adolescent male would presumably be those of enormous cultural and social significance, such as genital changes. Jones and Bayley state that "it is doubtful if any single event in the maturing process for boys can be compared in psychological importance to the menarche in girls" (1950, p. 146). The growth indicator employed by these writers, skeletal development, has "received no cultural value-assessments" (p. 146) and would therefore be expected to show only negligible relationships to behavior in contrast to the high positive relationship expected between the male's genital development and his behavior. This relationship, however, may well be a function of many variables which do not always channel the data in the expected direction. Bayley acknowledges the many variables involved in such relationships by saying that "we must assume that somatic androgony is only one of a multiplicity of factors which may influence the direction of a person's interests" (1951, p. 59).

It was then decided that pubic hair growth would be used as the growth indicator because of its probable psychological significance and because of its close relationship to other areas of sexual and physical development (Stolz and Stolz, 1951). The modified Davenport Scale, described and illustrated by Stolz and Stolz (p. 318), served as the instrument by which developmental status as indicated by pubic hair growth was determined.

D. Choice of Subjects

Forty-two boys, 20 seventh graders and 22 eighth graders, in the Leon County High School, Tallahassee, Florida, served as subjects for the study. The chronological age range extended from 12 years to 15 years; much age overlapping between grades occurred. Also much overlapping in developmental status occurred with many of the seventh graders being as mature (on the pubic hair scale) as the most mature eighth graders. These factors merit consideration in the analysis of the data.

E. Nature of the Data

1. *Physical Growth Measures*

The 42 subjects were examined in order to determine their physical growth status as indicated by pubic hair development. With the assistance of a local pediatrician[2] the writers, using the Davenport Scale, appraised the maturity of pubic hair development of each of the boys. The scale, a seven-point device extending from "0" (extreme immaturity) to "6" (adult status), clearly separated the subjects, showing a wide range from extreme immaturity to adult status. Extreme immaturity (ratings of "0") was characteristic of nine boys in the seventh grade and two boys in the eighth grade, and a rating of "6" (complete maturity) was characteristic of only one boy, an eighth grader. The wide distribution of the sample provided an adequate group for testing the hypothesis that the rapid physical changes of adolescence are of influence on the "self-concept" of the boy in the pubescent cycle of development. Table 1 shows the nature of the distribution of

TABLE 1
Pubic Hair Maturity Ratings of Forty-Two Seventh and Eighth Grade Boys

Grade	*CA*	Pubic hair maturity ratings 0	I	II	III	IV	V	VI	Totals
Seven	12 years	6	1	1	1	—	—	—	9
	13 years	2	1	—	1	—	—	—	5
	14 years	1	—	—	1	—	—	—	2
	15 years	—	—	—	—	—	3	—	3
Eight	12 years	—	—	—	—	—	—	—	0
	13 years	2	2	1	1	2	3	—	11
	14 years	—	—	—	3	4	1	1	9
	15 years	—	—	1	2	—	—	—	3
									Total $N = 42$

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[2] The assistance of Dr. E. W. Ekermeyer must be acknowledged in that several hours of consultative services and a physical examination of the 42 subjects were fitted into a very busy appointment schedule.

pubic hair maturity ratings according to age and grade. Having established this physiological classification of the subjects, the data relating to the self-concept were treated.

2. *Social Maturity and Pubic Hair Ratings*

One of the best known devices for appraising social maturity is Doll's *Vineland Social Maturity Scale* (1946) which evaluates social maturity in terms of overt expression rather than in terms of attitude or preference. Because it was desired to secure quantitative indications of the subject's "self-concept" of social abilities and limitations, rather than a detailed social performance record, some modification of Doll's scale was required. An adaptation of items in the Vineland was made between nine and 15 in the form of a five-alternative multiple choice test. This instrument has been called the *Self Concept of Social Maturity Scale.*[3] A typical item to which the subject responded by checking one answer follows:

> *Year 10.* I play games such as baseball, football, basketball, tennis, checkers, or other rather difficult games. I understand the rules and methods of scoring.
> I do it regularly ________
> I do it sometimes ________
> I have never done it, but I could do it if I wanted to ________
> I do not do it ________
> I cannot do it ________

All items between years nine and 15 were modified in this fashion. The total scale contained 20 items distributed over the seven-year period; to respond to any item the subject was instructed simply to check the alternative which best described him. Scoring on a five-point scale was then made possible with "I do it regularly" being scored as five points and each alternative counting one point less down to "I cannot do it" which was allotted one point. The possible scoring range for the entire series then extended from 20 to 100.

An examination of the relationship between Self Concept of Social Maturity scores and the pubic hair ratings yielded a Pearson-r of +.56. This value, significant at beyond the .01 level of confidence (Table 2), demonstrates a relationship between the subjects' self-concepts of social maturity and their physical maturity which merits consideration by those who work with adolescents. The significance of this relationship may be further enhanced by observing the correlation coefficient of +.24 (Pearson-r) obtained between the Self Concept of Social Maturity scores and chronological age. These two values (+.24 and +.56) were found to differ significantly (beyond the .05 level of confidence). The self-concept of social maturity (perhaps to be described as the way one sees oneself meeting the normal developmental social tasks of childhood and youth) of these subjects showed a closer relationship to the measures derived by pubic hair ratings than to chronological age. The original hypothesis gains strong support by this finding and further work of this nature with the Self-Concept of Social Maturity scale is suggested.

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[3] Adapted with the permission of Dr. E. A. Doll. Further work by the writers in revising this scale is in progress.

TABLE 2
CORRELATION COEFFICIENTS BETWEEN BOTH PUBIC HAIR MATURITY RATINGS AND SELF-CONCEPT OF SOCIAL MATURITY SCORES AND CHRONOLOGICAL AGE

Maturity measure	n	Pearson-r	p
Self-concept of social maturity	42	+.56	$<.01$
Chronological age	42	+.24	$>.05$

3. *Human Figure Drawings and Pubic Hair Ratings*

Human figure drawings, particularly of children and adolescents, have been of interest to psychologists for the last 70 years. This interest has centered on both developmental trends (Hall, 1883) and on drawings as offering clues to aspects of the personality. Goodenough (1926) used the human figure drawing to measure intelligence while the human figure drawing as a projective technique has been studied extensively by Machover (1949) who has provided many stimulating hypotheses for interpretation. Various writers have suggested relationships between an individual's human figure drawings and his social adjustment (Fiedler and Siegel, 1949; Yepsen, 1929; Hinrichs, 1935; Ochs, 1950). Levy (1950) has been explicit in describing the projective aspects of the human figure drawing by writing: "I have concluded that a drawing may be a projection of self-concept . . . an expression of . . . attitudes toward life and society in general" (p. 266). Most investigators have agreed that objectification of the method is needed.

In this study an objective analysis of the human figure drawings was made by using a check list of 52 drawing characteristics determined by a survey of procedures reported in the literature (Anastasi and Foley, 1943, 1944; Brown and Goitein, 1943; Elkisch, 1945; England, 1943; Goodenough, 1926; Lebo, 1951; Machover, 1949, 1951; McCarty, 1924; Mott, 1945; Royal, 1949; and Wachner, 1946). In some instances parts of the procedures of two or more writers have been combined into one entity or classification. Several standards of comparison are original with the writers.

In the interest of brevity, these items have been reduced for presentation to the following 11 categories:

1. Hair on head and body.
2. Shading, nature of lines and strokes, erasures.
3. Proportion.
4. Male adornment: cigarettes, cigars, pipes, adam's apple.
5. General adornment; clothing.
6. Body characteristics: bust, profile, hands and legs, chest.
7. Comparison of area of male and female figure.
8. Location of drawing on paper.
9. Sex drawn first.
10. Completeness of drawing; amount of detail.
11. Age of figure drawn.

These characteristics were examined in both the male and female figures of the pre- and post-pubescent subjects. In order to obtain cells sufficiently large to treat by chi-square analysis, it was necessary to place the cutting point on the pubic hair scale between ratings of *2* and *3*. Pre-pubescent in this section of the paper refers to subjects with ratings of *0, 1,* or *2* while post-pubescent refers to subjects with ratings of *3, 4, 5,* or *6*. The low correlations obtained between pubic hair maturity ratings and intelligence (an r of +.11 with Kent *EGY* (1942, 1943) scores) and personality scores (an r of —.05 with Part I, California Test of Personality (Thorpe, *et al.,* 1942)) give some assurance that an examination of the drawings on the basis of pubic hair maturity ratings will not include drawing characteristics immediately referable to either intellectual or emotional factors.

The analysis of these data was made by comparing the responses of the pre- and post-pubescent subjects on the 52-item check-list; a frequency count was made for each item. To test the significance of the difference between the responses of the 18 pre-pubescent and 23 post-pubescent youth who completed the drawings a chi-square was then run on each of these characteristics. The results of the human figure drawing analysis are summarized:

1. Twenty-five drawing characteristics as applied to either male or female figure on first inspection appeared large enough to warrant chi-square analysis.

2. All subjects drew the male figure first. Sexual identification evidenced by sex of drawings showed no disturbance in this group. To Machover (1951) drawing a figure of the opposite sex first is "evidence of confusion of sexual identification" (p. 360). Smith (1953) has presented data on 1,401 boys and girls distributed throughout the 12 school grades; approximately 20 per cent of her males drew the female figure first. The data of the present study suggest a clear and realistic sex-rôle identification based on the criterion of drawing *own sex first.*

3. The boys with higher pubic hair maturity ratings showed a tendency, however not rigorously verified by statistical treatment, to more frequently include on their drawings of male figures such characteristics as moustache, whiskers, long hair, and heavily shaded hair. The attention given to hair on the male figures yielded a chi-square value significant below the .06 level of confidence. To Machover (1951) hair plays an important rôle in the sphere of sexual symbolism. It would seem that the adolescent boys endowed with more mature development of pubic hair actively projected their stronger feelings of sexual virility and power into the males they drew. The body-image would appear to show some relationship to actual body changes.

4. The pre-pubescent males (as compared with the post-pubescents) demonstrated a marked tendency to give their male figure drawings such masculine objects as cigars, pipes, cigarettes, scars, masks, and accentuated adam's apples. The chi-square value obtained here reached a significance level beyond .01 thus leading to the inference that adolescent boys with immature pubic hair development resort to a different manifestation of sexual symbol. The pre-pubescent group resorted to the use of masculine articles other than hair in asserting male sexuality. It may be here suggested that the pre-pubescent male has need of proving his masculinity and achieving the adult body image; the preponderance of the sample seem to project their needs and feelings of inadequacy into their drawings.

5. Another point of differentiation of the pre- and post-pubescent youth was the significantly stronger tendency of the latter (chi-square value significant beyond the .01 confidence level) to adorn their male figures with neckties. Machover (1951) noted that ". . . ties are generally regarded as symbols of sexual adequacy, expressed on a social and clothing level" (p. 359).

6. In comparing size of the male and female human figures it was found that the post-pubescent group, significantly more often than the pre-pubescent group, drew their male figures larger than their female drawings (chi-square significant beyond the .02 confidence level). It may be speculated that the recognition of adequacy in the male's body-image and its clear significance to the post-pubescent subjects resulted in their greater male-female ratio of drawing area.

7. Other characteristics of the human figure drawings failed to show differences between the pre- and post-pubescent youth which could not be reasonably attributed to chance factors.

In summary additional support for the original hypothesis has been obtained; the self-concept, defined in terms of projections in the human figure drawings, appears to reflect in many ways the physiological changes of adolescence.

4. *Paragraph Completions and Pubic Hair Ratings*

Some of the obvious tasks of the boy or girl moving through the adolescent period are those concerned with heterosexual adjustment and emancipation from parents. In order to elicit additional responses from the subjects on these topics in a manner revealing the individual's self-attitudes without his being aware of the purpose of the task, a free response situation was arranged in which incomplete paragraphs were presented to the subjects. Written responses in the form of completing two stories were obtained. The subjects were directed to complete the following stories:

a. Heterosexual development. "John, Ed, and Tom are at the lake for a swim on Saturday afternoon. The boys borrow a boat and oars and are preparing to row out into the lake when Mary and Jane (girls who are in their room at school) arrive at the lake and say 'hello' to the boys. Then, . . . (please continue the story)." It will be noted that the range of possible responses is practically unlimited in that signs of maturity or immaturity in one's self-concept can be demonstrated in his treatment of a social situation demanding some kind of response to girls. The fact that there are three boys and only two girls leaves the individual boy free to go along with the crowd as a passive member, to leave the crowd completely, or to ignore the numerical difference and have the boys as a group act either friendly, indifferent, or antagonistic toward the girls.

The analysis of the responses to this situation demanded some arbitrary decisions in assigning quantitative values to the several kinds of possible conclusions. A first step in determining these values was to examine all the stories and arrange categories or groups of responses in that many stories were similar in content; five categories resulted from this grouping.

These categories were then arranged on a continuum ranging from very mature to very immature by ratings in terms of maturity of behavior and feeling by six psychologists (teachers in the areas of child and clinical psychology). The categories, arranged on the five-point scale from maturity to immaturity and reaching an average agreement on each item of 87 per cent between the raters, were of the following nature: (*a*) boys requesting girls' company in boats and later continuing their interests by suggesting dates for the evening; (*b*) boys requesting girls to accompany them and the male frequently becoming the hero in rescuing the girls from the lake; (*c*) permitting the girls to accompany the boys but no suggestion of interest in the girls; (*d*) greeting the girls but making no advances; and (*e*) ignoring or escaping the girls. The distribution of scores on the five-point scale appeared by inspection to be distributed normally with a massing of scores around the central point of the scale.

In first examining the data the relationship was obtained between measures of maturity (pubic hair ratings) and the self-concept (as defined by the heterosexual development item). This value ($r = +.17$) failed to reach the "acceptable" .05 level of confidence (Table 3). It will also be noted (Table 3) that chronological age correlated +.37 ($p = < .02$) with the self-concept of "heterosexual development" item, thus demonstrating a closer relationship than was exhibited by pubic hair ratings. Although the expected direction of relationship was found to exist between maturity of pubic hair development and maturity of self-concept of heterosexual development, the relationship ($r = +.17$) did not attain the expected significance level. An inspection of the data suggested marked differences between pre- and post-pubescent youth which are not revealed by correlational procedures.

TABLE 3

CORRELATION COEFFICIENTS BETWEEN BOTH PUBIC HAIR MATURITY RATINGS AND CHRONOLOGICAL AGE AND SELF-CONCEPT OF HETEROSEXUAL DEVELOPMENT

Maturity measure	n	Self-concept of heterosexual development Pearson-r	p
Pubic hair maturity ratings	42	+.17	>.05
Chronological age	42	+.37	<.02

It must be concluded that these data fail to support convincingly the hypothesis that an index of physical maturity such as pubic hair development will be significantly related to the pubescent male's self-concept as he projects himself into heterosexual situations. However, these findings do emphasize the developmental or changing aspect of the individual's self-concept. The relationships he visualizes between himself and girls of his age group may well depend upon both physical maturity and increased opportunities (time) for experiences—learning which would occur with added years of home, school, and community experiences.

b. Emancipation from parents. "Tom is about grown and has left home and school to go to another town 300 miles away to work. However, when he arrives at the town, he finds that he must wait two days before he can begin his job. His parents would like to have him come home and stay. He will only have enough money to pay for his food for one of the two days he must wait before beginning his job. Tom decides . . . (please continue the story)."

The above paragraph was designed to determine the strength of home ties of the subjects. Again it will be noted that a wide range of possible solutions exists; it was expected that strength of home ties would be demonstrated by the boys' determination to "stick-it-out" or by the readiness with which they turned back to their homes for the solution to the problem. A continuing dependence on parents would be evidenced by a readiness to return home, to turn to parents for assistance. That a self-concept of unreadiness to enter the adult world will be demonstrated by the pre-pubescent boy and a self-concept of adequacy and self-confidence will be demonstrated by the post-pubescent boy is the hypothesis to be tested.

The responses to the "Emancipation from Parent" item were arranged in order of maturity value in the same fashion as were the "Heterosexual Development" items. Categories of responses ranging from extreme immaturity to maturity were developed and all responses then assigned a position on the five-point scale. The arrangement of responses (from mature to immature) by the six psychologists was of the following nature: (*a*) the decision was to wait-out the remaining time, to get by with limited funds; (*b*) borrow money from the prospective employer or get a temporary job; (*c*) stay at the town but wire or write home for money; (*d*) abandon the job, return and stay with parents; and (*e*) turn to luck or fantasy for solution of the problem. There was an average agreement of 75 per cent by the six psychologist raters on the location of each item in the scale.

TABLE 4

CORRELATION COEFFICIENTS BETWEEN BOTH PUBIC HAIR MATURITY RATINGS AND CHRONOLOGICAL AGE AND SELF-CONCEPT OF EMANCIPATION STATUS

Maturity measure	n	Self-concept scores on emancipation status Pearson-r	p
Pubic hair maturity ratings	42	+.27	>.05
Chronological age	42	+.40	<.01

The obtained responses tended to be distributed normally along the five-point scale; both seventh and eighth graders appeared in each of the five categories. Early inspection of the data suggested a tendency for the more mature individuals to rank higher on the "emancipation from parent" item.

Correlational analysis of these data with pubic hair maturity ratings was made (Table 4); a coefficient (Pearson-r) of +.27 ($p = > .05$) was obtained which fails to reach the commonly accepted .05 confidence level. Chronlogical age again showed the closer relationship to the self-concept item by correlating +.40 ($p = < .01$) with the "emancipation from parents" score. Again the expected direction of relationship was not found sufficiently strong to support the original hypothesis in any convincing manner. However, the evidence is suggestive of a relationship between physical status and the adolescent male's self-concept in regard to dependency on parents. The higher chronological age relationship shown again impresses the writers with the necessity of time and experiences which are important in structuring the male rôle with which the adolescent boy identifies. The younger, less mature male tends to see himself as a little boy able to assume only limited responsibility for his own well-being and still relying heavily on his parents' protective care. The older and more mature adolescent males appeared to think themselves capable of meeting the exigencies of unfamiliar and trying circumstances.

In summary it will be noted that while the relationships have not been consistently close and uniform between the pubic hair maturity ratings and the self-concept in areas of "heterosexual development" and "emancipation from parents," the relationships which do exist are of such nature as to suggest further investigation of the influence that the physical and physiological changes of puberty have upon the self-concept of the adolescent male. Both the experiences coming with increased age and sexual maturity with its obvious external evidence associated with the prestige system of adolescent youth appear to be reflected in the individual's self-concept in regard to these important social relations.

F. Summary

The problem investigated was the relationship between the self-concept of pubescent males between years 12 and 15 and physical maturity as evidenced by the maturity of pubic hair development. The 42 subjects were classified according to pubic hair maturity ratings. The self-concept, as revealed through projective material, was then examined in relation to the pubertal status (pubic hair ratings) of the subjects. The following findings were reported:

1. A wide range of pubertal status (pubic hair maturity ratings) was reported; many of the younger subjects were as mature as the older subjects.
2. The "self-concept of social maturity" as indicated by the subjects' responses to items of a modified version of the *Vineland Social Maturity Scale* showed a marked positive relationship to pubic hair maturity status (Pearson-r of $+.56$, $p = < .01$), while chronological age and pubic hair maturity ratings showed a less significant relationship (Pearson-r of $+.24$, $p = > .05$).
3. Pre- and post-pubescent males differed significantly (beyond the .05

confidence level) in certain projective aspects of their human figure drawings. Adequate sex-rôle identification in all subjects was assumed from the fact that all subjects drew the male figure first. Post-pubescent as compared with pre-pubescent males appeared to project their stronger feelings of sexual virility or masculinity into the males they drew by their excessive attention to hair. Pre-pubescent as compared with post-pubescent males appeared to express their need for proving masculinity and achieving the adult body-image by their excessive use of masculine objects as cigars, pipes, cigarettes, scars, masks, and adam's apples. The post-pubescent as compared with the pre-pubescent males tended more often to adorn their male figures with neckties, a characteristic described by some writers as evidence of a feeling of sexual adequacy. Finally, the post-pubescents differed from the pre-pubescents in their apparent recognition of adequacy in body-image in that their male drawings were consistently larger than their female drawings.

4. Measures of self-attitudes in the area of heterosexual development showed a closer relationship to chronological age (Pearson-$r = +.37$, $p = < .02$) than to pubic hair maturity ratings (Pearson-r of $+.17$, $p = > .05$) suggesting that the adolescent male's self-attitudes in relation to girls is more dependent upon experiences (age) than upon his degree of physical maturity.

Measures of self-attitudes in relation to parents (emancipation from parents) also showed a closer relationship to chronological age (Pearson-r of $+.40$, $p = < .01$) than to pubic hair maturity ratings (Pearson-r of $+.27$, $p = > .05$). These findings also suggest that the adolescent male's self-concept in relation to his dependency on or independence of parents is more closely related to experiences (age) than to the degree of physical maturity attained.

5. Finally, the data reported are of some practical importance as they emphasize the self-concept as an important and productive area of investigation in studies of pubescent youth. Longitudinal investigations of the relationships between physical growth and personality development during the pubescent cycle may well add valuable interpretative material to the psychology of adolescence.

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SOME STIMULUS VARIABLES AFFECTING THE DISCRIMINATION OF OBJECTS BY MONKEYS*[1]

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A. PROBLEM

This experiment was designed to evaluate factors influencing the accuracy with which planometric and stereometric objects are discriminated by monkeys. Specifically, the effect of varying the surface area and height (thickness) of objects upon form and upon color discriminations was investigated.

It has been generally agreed (3, 5, 8, 9, 10) that color is a more potent cue than form for monkeys and chimpanzees; indeed, it has been found that differences in color alone are as discriminable as differences in both color and form (5, 9). The only dissenter since Revesz (11) has been Chow (1), who reported that naïve monkeys made significantly fewer errors in discriminating contours than in discriminating colors, brightnesses, or patterns. Comparison of planometric and stereometric objects was made by Harlow (6) who found that planometric objects were as discriminable as stereometric objects.

B. METHOD

1. *Subjects*

Eighteen young rhesus monkeys served as *S*s in this experiment. Prior to the present experiment all the *S*s had identical testing histories, consisting of 15 days' testing on a 15-pair concurrent discrimination problem (see 4), 36 days on a difficult pattern discrimination problem, and 5 days' retesting on the concurrent discrimination habit.

2. *Apparatus and Procedure*

The Wisconsin General Test Apparatus (7, Figure 1) was used throughout. The construction of this apparatus and the standard test trial procedure have been described in previous publications.

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[1] This research was conducted in the USAF School of Aviation Medicine Primate Laboratory, at the University of Texas, Austin, Texas.

3. *Experimental Design*

The 18 pairs of objects used in this study differed with respect to three variables, surface area, thickness, and either form or color. The objects were regular geometrical forms, each painted a homogeneous color, with surface areas of either 3 or 6 sq. in., cut from ¼″ plywood (defined as planometric objects) or from 2″ lumber (defined as stereometric objects). Three combinations of areas (3-3, 3-6, and 6-6 sq. in.) and thicknesses (planometric-planometric, planometric-stereometric, and stereometric-stereometric) could occur within pairs; these area and elevation conditions such that there were nine joint area-elevation combinations. These nine basic area-elevation conditions were replicated in combination with form and with color differences.

Each day for nine days, the *S*s were tested on two discrimination problems, all problems consisting of 25 non-correction trials with a single pair of objects. One form and one color discrimination were presented each day. Form and color were regularly alternated throughout the experiment, to minimize interproblem transfer.

The design was an 18 x 18 latin square, with *S*s, ordinal position (learning), and objects as main effects. Portions of the sum of squares due to objects may, in turn, be assigned to identifiable sources of variation, as indicated by the factorial analysis included in Table 1.

C. Results

The analysis of variance, summarized in Table 1, indicates that individual differences and ordinal position are not significant sources of variation, and that the variance due to Objects is significant at the 1 per cent level of confidence. Inspection of the several sources contributing to the sum of

TABLE 1
SUMMARY OF ANALYSIS OF VARIANCE

Source	*df*	Mean square	*F*	*P*
Subjects	17	28.08	2.05	
Ordinal position	17	12.41	1.00	
Objects	17	60.65	4.42	.01
Form versus color	1	3.57	1.00	
Area	2	131.27	9.57	.01
Elevation	2	44.91	3.28	.05
F — C x A	2	57.42	4.19	.05
F — C x E	2	16.25	1.19	
A x E	4	38.38	2.80	
F — C x A x E	4	93.57	6.82	.01
Error	272	13.71		
Total	323			

squares for Objects reveals that the difference between form and color discrimination problems is not significant and that area, elevation, and the F-C x A and F-C x A x E interactions are significant at or beyond the 5 per cent level of confidence. Neither area nor elevation are significant when tested against the F-C x A x E interaction.

Thus, the analysis of variance indicates that none of the individual independent variables was unequivocably significant. The most effective factor determining the significant variations in difficulty among the problems was, rather, the number of differential cues available.

Table 2 shows the mean per cent errors and the frequency of immediate solutions (P of number of correct responses $< .01$) as a function of the number of available cues. The percentage of errors is 4.8 less when two cues are available than when only one is present, and a decrease of 9.2 per cent in error frequency results from increasing the number of cues from two to three. The values of the t's for related measures (t for one versus two cues $= 3.28$; t for two versus three $= 8.65$, 17 df) indicate that these differences are significant beyond the 1 per cent confidence level. The differences in the frequency of immediate solutions as a function of the number of cues is equally impressive.

TABLE 2

PER CENT ERRORS AND PERCENTAGE OF IMMEDIATE SOLUTIONS AS A FUNCTION OF THE NUMBER OF AVAILABLE CUES

Cues	Number of problems	Mean per cent errors	Mean immediate solutions
Form	4	18.0	70.8
Color	4	24.4	59.7
Mean: One cue	8	21.7	65.3
Form and area	2	16.6	69.4
Form and elevation	2	20.4	66.6
Color and area	2	14.0	83.4
Color and elevation	2	16.8	75.0
Mean: Two cues	8	16.9	73.6
Form, area and elevation	1	8.3	94.4
Color, area and elevation	1	7.0	100.0
Mean: Three cues	2	7.7	97.2

D. DISCUSSION

The results of the present experiment failed to corroborate the findings of previous investigators who reported that either color (3, 5, 8, 9, 10) or form (1, 11) is significantly less difficult than other sorts of discrimination problems. The finding of significant interactions in this experiment implies that the particular color and form differences varied considerably in difficulty and suggests that the alleged superiority of either cue, reported in previous studies, may be a function of the particular experimental conditions.

Again, in contrast to the findings reported by earlier investigators, striking evidence for the additivity of cues was obtained. The magnitude of the difference in performance between one- and three-cue problems is similar to the amount of facilitation occasioned by combining stimulus cues in different modalities (2).

E. SUMMARY

Eighteen monkeys were tested on 25-trial object discrimination problems. The pairs of stimuli differed with respect to three variables: area, elevation, and form versus color. The following results were obtained.

1. Form and color differences were equally discriminable.
2. With both members of a pair of objects identical in area and elevation, the absolute value of these variables had little effect on performance.
3. Discrimination performance was facilitated when differences in either area *or* elevation were combined with form or color differences; performance was greatly facilitated when differences in area and elevation were combined with color or form differences.

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A SZONDI STUDY OF DEVELOPMENTAL AND CULTURAL FACTORS IN PERSONALITY: THE SEVEN-YEAR-OLD*

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A. PURPOSE AND PROCEDURE

The purpose of this study is to determine which aspects of personality in a specific phase of growth are developmental, and which are culturally determined. The procedure comprises the following major steps: (*a*) investigation of general personality tendencies common to certain groups of seven-year-old children in our culture; (*b*) comparison of dominant personality patterns of four cultural sub-groups in our culture with each other; and (*c*) relation of our findings to other comparable data on seven-year-old children from other cultures.

It was decided that the Szondi Test be used because it is a depth projective technique which represents personality dynamics in a structured pattern. These patterns can be compared with each other by statistical methods. Furthermore, although this test must be administered at least six separate times for purposes of clinical diagnosis, it seems that for determination of gross group trends a single administration per subject, which takes about 10 minutes, is adequate.

The Szondi Test was individually administered to 200 seven-year-old children comprising the following four groups: (*a*) 50 white public school children from middle class residential section of Brooklyn (25 male, 25 female); (*b*) 50 white progressive private school children from three well-known progressive schools in New York City (24 male, 26 female); (*c*) 50 Negro children from low income groups in Harlem (25 male, 25 female); (*d*) 50 Puerto Rican children from low income groups in Harlem (25 female, 25 male).

Table 1 shows the dominant Szondi patterns for each of the four groups, totaling 200 children.

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B. TYPICAL SZONDI PATTERN OF THE SEVEN-YEAR-OLD

Table 1 shows that our four groups of seven-year-old children have almost identical Szondi trends. Although the percentages vary somewhat, the same predominant pattern is found in all four groups. Thus we find a personality picture that seems to hold for seven-year-old children from all four of the cultural sub-groups. This would seem to justify the conclusion that there is an over-all tendency toward the following Szondi pattern in seven-year-old children in our culture:

TABLE 1
PERCENTAGES OF RESPONSES IN EACH SCORING CATEGORY OF THE SZONDI TEST FOR FOUR GROUPS OF 50 EACH OF SEVEN-YEAR-OLD CHILDREN: PREDOMINANT TENDENCIES ARE IN ITALICS

		h	s	e	hy	k	p	d	m
A. White pub. sch., middle class	Plus	*88*	*84*	24	4	10	8	22	6
	Minus	2	6	*30*	*80*	*40*	*56*	30	*72*
	Plus-minus	4	2	24	4	16	2	8	8
	Open	6	8	22	12	34	34	*40*	14
B. White Prog. private sch.	Plus	*82*	*74*	*34*	4	4	10	12	12
	Minus	2	10	18	*76*	*56*	*52*	22	*56*
	Plus-minus	10	6	24	12	14	8	6	10
	Open	6	10	24	8	26	30	*60*	22
C. Negro low income	Plus	*82*	*54*	28	6	20	14	18	20
	Minus	6	18	16	*58*	*50*	*42*	18	*50*
	Plus-minus	8	6	*34*	18	22	16	8	12
	Open	4	22	22	18	8	28	*56*	18
D. Puerto Rican low income	Plus	*80*	*58*	*38*	8	12	12	22	4
	Minus	2	10	14	*54*	*46*	*62*	24	*70*
	Plus-minus	12	14	28	14	10	10	2	12
	Open	6	18	20	24	32	16	*52*	14

Factors:	h	s	e	hy	k	p	d	m
Predominant tendency:	+	+	*	—	—	—	0	—

*(No predominant tendency.)

This typical pattern should be considered in terms of our understanding of the psychology of the seven-year-old child. Following is an analysis of each of the Szondi factors predominantly chosen:

1. *Plus s*

Here is the active child whom we all know; we see these children on the street playing their war games. When "shot" they double up and fall dramatically to the ground. There is no inhibition of gesture language at this age, and the world is a place for these children to master physically through doing and trying with their hands and all their muscles. Expression is concrete and outgoing.

Interesting relevant findings were reported regarding seven-year-olds in Biber *et al.*'s study (1); they found that given a problem-solving test it was difficult for these children to come to a plan of solution without touching the objects and working out the solution concretely. They could not inhibit an impulse to trace a maze in the air during the maze tests. They were at their best in dealing with concepts involving active observable elements that could be manipulated. In short, the seven-year-olds are only just beginning to be able to handle abstract concepts. Their thinking is mostly concrete and they are beginning to move from the particular to the general, the direct to the vicarious.

The seven-year-olds almost violent taking of sides may perhaps also be thought of as a *Plus s* quality. He often comes out with strong expressions of hate for the public enemies he hears adults discussing—such as Hitler, etc. In fact, what he hates, he hates violently; what he likes, he adores. He lets strong feelings flow out in these socially accepted channels.

2. *Minus hy*

Yet the Szondi pattern indicates that the seven-year-old is not typically exhibitionistic. His expression of feeling is not that of the highly personal *hy* quality, related directly to his personal fantasy. On the contrary, the Szondi pattern reflects a strong tendency toward conformity. He does not want others to know what his feelings are if they are different from anyone else's. He must find and take his place in his own social group to the extent that he will deny his individuality to merge with the others. He takes on the ways of talking that are current in his gang, including all the cliches and stereotyped expressions. He now enjoys being part of organized games.

There is now evident a growing distance between himself and the adults of his world. Although he still needs and loves his parents he cannot go to them in quite the same way he did at four. He does not want to be babied and cuddled now. He does not want to tell his parents all his secrets. He feels he is well on the way toward becoming an adult himself, and is beginning to take on an identification with the adult rôle. But there is some anxiety involved in this new independence, and this too is reflected in the *Minus hy*.

3. *Minus m*

The previous pattern is very closely related to their choice of the *Minus m*. The *Minus m* in these seven-year-olds represents a denial of the need to lean on others, particularly on the mother. The maternal tie is well on the way to being broken, but not without a sense of isolation and unsatisfied need for attachment.

4. *Open d*

The need for emotional independence from the mother represented by *Minus m* is also reflected in the choice of *Open d*. This response indicates an aimless searching for new sources of attachment, or for new satisfactions. He is interested in everything and everyone, but not for too long or with too great an intensity. His restlessness is apparent in his being carried along from one fad to another on the current of popular opinion and preference.

5. *Varied e*

The seven-year-old is by no means completely free of conflict with the adults in his life, however. He wishes to be "free" of them in an emotional way, as he was not free at age four. Yet he really is still a child under their authority. He must cope with his own resistance and rebellion, on how much he can rely on his own conscience, his parent surrogate. Children at seven work out these problems in various ways. Some attempt more overt resistance, others show more highly developed self-control, and many children fluctuate from one time to another. These individual differences are reflected in the varied responses these children give to the *e* factor. There is no one direction significantly greater than another. It should also be noted that this factor is the most variable for the population at large.

6. *Plus h*

Just as the seven-year-old is still really a child, under the authority of adults, so is he too, basically a child in need of tenderness and affection—the epitome of *Plus h*. When considered as a pattern the *Plus h, Plus s* constellation is indicative of an active, realistic child not yet capable of involvement in the abstractions that may later attract him.

7. *Minus k, Minus p*

We have said nothing yet specifically of the *Minus k, Minus p* picture in the seven-year-old's profile, though everything we have pointed out is pertinent and reflects on the formation of this particular ego structure. This is the ego picture of the child whose needs come rushing at him without his knowing where they come from or what they are; he simply acts to meet them. Concrete action is his keynote, and it serves to integrate him with his companions as well as the demands of the world about him. He cares about himself only when he sees that self measuring up to the visible standards set by this age group. Conformity is the rule—though indeed it is a thing not always easy for him to come by. He may hold up very high standards for the kind of achievement that means to him "belonging." Adaptation is thus not so easily achieved.

By the preceding analysis the investigators have attempted to evaluate the factors which are common to this group of 200 seven-year-olds.

C. SEX DIFFERENCES

Within the "typical profile" of the seven-year-old, there are certain statistically significant differences in emphasis between the boys and the girls.

The girls have significantly more *Plus h* and *Minus s* and fewer *Plus s* responses than do the boys. The investigators hypothesize that these Szondi differences are related to the traditional sex-typing which is beginning to make itself felt. Girls are reaching toward the feminine, soft attributes, boys are feeling the pressures to become masculine and "hard boiled." Also, perhaps boys have a greater store of motor energy to discharge at this stage of their development.

TABLE 2
SEX DIFFERENCES IN SEVEN-YEAR-OLD CHILDREN

Predominant Group tendencies in Szondi categories and percentages of response	h	s	e	hy	k	p	d	m
Males (*N* = 99) scores	+	+	*	—	—	—	0	—
Per cent	77	75		69	56	49	52	65
Females (*N* = 101) scores	+	+	*	—	—	—	0	—
Per cent	89	60		65	40	57	52	59

Significant differences to the 5 per cent level between males and females in Szondi scoring categories chosen (chi square)

Factor	Higher	Per cent	Lower	Per cent
+h	Females	89	Males	77
+s	Males	75	Females	60
—s	Females	16	Males	6
0e	Females	29	Males	15
—k	Males	56	Females	40

*No predominant tendency.

That sex-typing is at work seems probable by the fact that this difference in *Plus s* does not occur between the boys and girls from the private progressive schools studied, where the traditional sex differences are not emphasized. In this regard, it is noteworthy that several of the other differences between the sexes which are mentioned below do not hold for the private progressive school children.

One of these male-female differences that appears is in the *e* factor. Though neither boys nor girls show any one marked tendency in this factor, the girls give significantly more *Open e* responses than the boys (except, again, for girls in the private school group). Any interpretation of this should be made with great caution, since the *e* factor is extremely variable, and we have only one profile from each child to go on. About all we can say is that there may be easier outlets for some of the girls, within certain of the home and school situations in our culture, for steady discharge of aggressive feelings. Perhaps it is again a matter of sex-typing, pushing the boy into a matter-of-fact masculinity which scorns personal emotion, whereas the girl may feel a little freer to express her emotions directly.

The third male-female difference is in the *k* factor, where boys give the majority of *Minus k* responses. It should be noted again that this difference scarcely exists in the case of the private school children. Trends in the *k* factor suggest that in our culture, among some groups at least, the boy may feel more pressure than the girl to conform to the gang, and to the restrictions of his environment. It may indicate that the boy conforms or is "broken in" before the girl is. This would be an interesting hypothesis to pursue further by actual observations of seven-year-olds, particularly since girls are regarded as being more docile throughout childhood.

D. Significant Differences between Groups

A statistical analysis of the data (using Chi square as a test of statistical significance) revealed several differences between the four groups which were significant to the 5 per cent level of probability, or less.

Both the Progressive school and the Public school white groups contained more children with *Plus s* (to the 1 per cent level of confidence) than either the Negro or Puerto Rican groups. The Negro group, however, had significantly more children with *Open s* than either of the two white groups. The Puerto Rican group also manifested a tendency (but not statistically significant) to give more *Open s*. Both *Open s* and *Plus s* indicate a need for physical activity and manipulation of the physical environment, but *Plus s* indicates that this need is in a continuous state of tension, whereas the *Open s* person is more fully discharging these tensions in activity.

The Negro and Puerto Rican groups tended to have fewer *Minus hy*'s and more plus-minus and *Open hy*'s than do either the progressive school or the public school white groups. This would indicate that among the Negro and Puerto Rican groups there are more children who act out their need for physical activity which is represented by the *s* factor.

The most significant difference in the *k* factor seems to be that the Negro group has more loading in this factor. This predominant choice in the *k* factor indicates that there are more children in the Negro group with overly strong ego defenses than there are in the other groups.

Although there are some differences between some of the groups in the *p* and *d* factors, perhaps the most important differences are found in the *m* factor. All groups manifest a predominantly *Minus m* response, but more Negro children choose *Plus m* and fewer choose *Minus m* than in any of the other groups. This *Plus m* tendency in the Negro group probably indicates that a higher percentage of Negro children in our sample have not yet progressed to the more typical seven-year-old stage of rejecting their need for parental dependence. Children with *Plus m,* according to concepts of the Szondi Test, are more prone to look to their environment for some sort of emotional support.

It is to be emphasized that interpretation of these differences between groups is most complicated and difficult and that only the most prominent ones are discussed in this paper. The relative uniformity in a basic pattern of predominant choices, it should be noted, is of much greater significance than are the differences.

E. COMPARATIVE SZONDI DATA FROM OTHER COUNTRIES

Dr. Charlotte Spitz (3) conducted a Szondi study in which she analyzed 10 Szondi profiles on each of 110 Swiss children from five to seven years of age. She found a pattern of predominant choices on the Szondi Test which is almost identical to that found in our study of American seven-year-olds (see Table 3). The only difference in predominant choices between the Swiss and American children is found in the *e* factor. This factor, it should be noted, is the most variable one on the Szondi generally.

TABLE 3
COMPARISON OF SWISS AND AMERICAN CHILDREN

	h	s	e	hy	k	p	d	m
Swiss, 5 to 7 y.o. ($N = 110$)	+	+	—	—	—	—	0	—
American, 7 y.o. ($N = 200$)	+	+	*	—	—	—	0	—

*No predominant tendencies.

The great similarity between the predominant Szondi trends of the Swiss and American children in our samples would seem to indicate that developmental factors are of primary importance in determining the personality traits of children of this age. In these groups we do not find great differences in Szondi patterns which would indicate that cultural differences for these groups are of secondary importance.

Finally, however, we have data from a preliminary Szondi study (2) of Cuban seven-year-olds which consists of one profile on each of 17 public school children and 18 orphanage children. Although the data is numerically too meagre for statistical analysis, there are several similarities with the American and Swiss groups. Predominant trends in the Szondi patterns of these Cuban children are the same as those of the American and Swiss groups in three factors: *Plus h, Minus k,* and *Minus m.* Thus we find in all groups tested of this age level: the need for tender love (*Plus h*), the need to escape disturbing urges or ideas by pushing their recognition out of consciousness (*Minus k*), and the need to free oneself from infantile emotional dependences (*Minus m*). Thus it seems probable that these are three fundamental factors which most typify the level of personality development of seven-year-old children. We, of course, need further cross cultural research to illuminate this hypothesis.

F. Conclusion

The findings of this study can be summarized as follows: Data obtained from a total of 200 seven-year-old children, composed of four equal groups differing in social or educational backgrounds, and sub-divided according to sex, show the same pattern of predominant choices on the Szondi Test. Minor variations in patterns of response were discovered between these groups and between the sexes.

The investigators also found that the pattern of predominant Szondi choices in the 200 American seven-year-olds was almost identical to that of 110 5- to 7-year-old Swiss children. In addition, data on two small groups of seven-year-olds in Cuba showed the same predominant trends in three factors as for the Swiss and American children. The authors believe that these predominant Szondi trends found in all groups or seven-year-olds tested are indications of basic developmental factors in personality common to this age group. There are also indications, however, that cultural or environmental forces may also influence personality factors measured by the Szondi Test.

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A COMPARATIVE STUDY OF ADOLESCENTS WITH THE SZONDI TEST*

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A. PROBLEM

In the preceding paper of this journal (2), data was presented that showed a similar pattern of predominant trends on the Szondi Test for four groups of American seven-year-old children differing in cultural, social, or educational background. Despite these similarities, there were also significant differences in Szondi tendencies between the groups and between the sexes. It was concluded that developmental factors were of primary importance in determining group Szondi patterns but that environmental factors such as culture or education are also an influence.

It is the purpose of the present paper to carry the previous research further and report data from single profiles of the Szondi Test on 88 adolescents between the ages of 14 years, zero months, to 16 years, zero months, with a mean age of 14 years, 10 months. Our purpose is to determine the distribution of scores on the Szondi Test for this age group and how they differ from those of the seven-year-olds. Sex differences for this 14-to 16-year age group will also be pointed out.

B. A COMPARATIVE ANALYSIS OF THE ADOLESCENT PATTERN

Table 1 shows the percentage of distribution of choices on the Szondi Test for 200 seven-year-old children previously studied (2) and for the 88 14- to 16-year-old adolescents. A glance at this table impresses us with the great differences between the patterns of these two age groups. In fact, if we make a statistical comparison (Chi square) between the distribution of scores for both groups, we find that out of 32 comparisons, all but three are significantly different to the 5 per cent level of reliability. We will therefore compare these two age groups for distribution of choices in each factor of the Szondi Test and relate these differences to developmental factors.

First of all, we notice that there is less tendency toward *Plus h* and *Plus s*, and more toward *Minus h* and *Minus s* in the adolescents than in the seven-year-olds. These differences make sense in that at this level of develop-

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ment the adolescent is less in need of tender maternal love. He is also more able to think in abstract terms and has greater capacity for sublimation. Also, there is more individual variation among the adolescents as indicated by the more even distribution of responses in the four scoring categories.

TABLE 1

	h	s	e	hy	k	p	d	m
A. Percentages of responses in each scoring category on the Szondi Test for 200 seven-year-old children (50 progressive school white middle class, 50 public school white middle class, 50 Puerto Ricans, 50 Negroes). Predominant tendencies are in italics.								
Plus	*83*	*68*	31	6	12	10	18	10
Minus	3	11	20	*67*	*48*	*53*	24	*62*
Plus-minus	8	7	27	12	15	9	6	10
Open	6	14	22	15	25	28	*52*	18
B. Percentages of responses in each scoring category on the Szondi Test for 88 Adolescents, 14 to 16 years old, equally divided according to sex (24 white lower class, 24 Negro lower class,** 40 white progressive school.†								
Plus	*63*	*33*	*45*	2	14	*40*	16	*45*
Minus	11	*35*	18	*66*	*54*	23	*52*	21
Plus-minus	11	12	11	16	15	10	8	10
Open	15	20	26	16	17	27	35	24
C. Predominant tendencies on the Szondi Test of 200 seven-year-old children and 88 Adolescents.								
7 y.o.	+	+	*	—	—	—	0	—
14-16 y.o.	+	*	+	—	—	+	—	+

*No predominant tendency.
**Tested by Susan Deri.
†Tested by E. Fancher, D. Wolf, and F. Fleck.

The adolescent is often concerned about broad general problems of social reform and ethics, and may be interested in radical political ideas. Such behavior is reflected in the higher rate of *Plus e* responses. It implies greater acceptance of principles of fair play and social responsibility.

Only in the *hy* factor do we find relatively little change in basic pattern between the two age groups. This seems to fit Harrower's findings (4) that the *hy* responses were least variable of all Szondi factors. It is possible that personality traits related to this factor are least changed by age, but more data is needed to confirm this hypothesis.

Although differences in the *k* factor are not as great as in other factors, there is a slightly higher rate of *Plus k* and *Minus k* responses, and fewer *Open k*'s in the 14- to 16-year-olds which indicates a higher level of ego development, and a greater tendency toward relying on insightful and integrative functions of the ego rather than repression as a way of handling emotional needs.

But the really significant difference in the area of ego structure is found in the *p* factor where there is a striking shift of responses from the *Minus p* in the seven-year-olds to the *Plus p* in the 14- to 16-year-olds. Deri (1) says:

> Tension in the *p* factor in either direction is indicative of the need to demolish the boundaries of the individuality and to fuse with the outer world: however, in the case of *Minus p*, this is not recognized as such by the person. . . . The need-tensions are acted out without having first passed through the system of preconscious, thus without their becoming linked to word images.

This more primitive and projective type of personality organization is far more frequent with the seven-year-olds than with the 14- to 16-year-olds.

The adolescent group on the contrary have a predominant tendency toward *Plus p*, which represents the same need for the ego to fuse with the environment as does the *Minus p*, but is different in that the primitive drives *do* pass through the preconscious and are linked to word images which can be verbalized. This does not mean that the real nature of these needs is recognized, but that they are usually perceived consciously in some form of conceptualization, which is acceptable to the ego. *Plus p* is found particularly among writers, and indeed perhaps its high rate among adolescents is related to that particular kind of intellectual hunger and tendency toward generalization about the nature of the universe that Anna Freud (3) and others have noted in adolescents. In fact, our interpretation of the *Plus p* in the adolescent seems to fit very well Anna Freud's observations that the intellectual preoccupations of the adolescent is really an attempt to work through increasing conflicts between the superego and the id by accepting some of the emotional tensions, but mastering them by intellectualizing them.

If we return to Table 1, we find very significant shifts of responses from the seven-year-old groups to the adolescent group in both factors of the contact vector. The *Open d* of the seven-year-old has changed into a *Minus d*. We explained the *Open d* in the seven-year-old as relating to the period of working through a new emotional independence from parental authority which seems to characterize the latency period with its relatively successful resolution of the earlier Oedipus phase. We must now try to understand why the tendency in adolescents is toward *Minus d*. The Szondi interpretation of the *Minus d* is that it indicates a tendency to attach oneself to one particular object or idea rather than to many. Concretely, this means that such people want to fall in love with one particular person or thing, for instance, they may become deeply attached to particular ideas or ideals, which may frequently be of a religious, political, or philosophical nature. Thus, they tend to be sentimental and idealistic, as are so many adolescents. Since *Minus d* is probably related to an original fixation on a primary love object, its strong occurrence in adolescents may be related to a brief resurrection of the Oedipus conflict of the beginning of puberty, as Nunberg believes occurs (5).

The strong shift in response from a *Minus m* in the seven-year-olds to a *Plus m* in the adolescents is closely related to the change in the *d* factor. It reflects a greater acceptance of the sources of support and satisfaction the world has to offer. It indicates a hope of satisfaction, a belief that one's need for another person, or on a sublimated level, for an idea or ideal, will be fulfilled, and represents a socially positive attitude in general.

C. SEX DIFFERENCES AMONG THE ADOLESCENTS

A glance at Table 2 shows that there is amazingly little difference in general Szondi pattern between the adolescent boys and girls. The most striking difference is in the *s* factor, where it is seen that the boys have a much stronger tendency towards *Plus s* and girls toward *Minus s*. This is indicative of the strengthening of the masculine qualities of aggressiveness and activity. This is a period of football playing and such for the boys. On the other hand, the girls at this age are becoming more womanly than ever, probably emerging from a tom-boyish stage of pre-adolescence, and adopting the more passive aspects of the feminine rôle.

TABLE 2
SZONDI PATTERNS OF ADOLESCENT FEMALES AND MALES

	h	s	e	hy	k	p	d	m
A. Females								
Percentages of responses in each scoring category of the Szondi Test for 44 females, aged 14 to 16 years. Predominant tendencies are in italics.								
Plus	*64*	20	*55*	0	14	*36*	23	*45*
Minus	14	*39*	16	*70*	*52*	27	*32*	20
Plus-minus	5	9	9	16	14	11	11	9
Open	18	*32*	20	14	20	25	*34*	25
B. Males								
Percentages of responses in each scoring category of the Szondi Test for 44 males, aged 14 to 16 years. Predominant tendencies are in italics.								
Plus	*61*	*45*	*34*	5	14	*43*	9	*43*
Minus	9	32	20	*61*	*57*	18	*50*	23
Plus-minus	18	16	14	16	16	9	5	11
Open	11	7	*32*	18	14	30	*36*	23

These changes are probably also related to the stronger tendency toward a *Plus e* and lesser tendency toward *Open e* among the girls than among the boys. This difference indicates that girls have a greater degree of control in expression of aggressive feelings at this age, and is probably related to the *Minus s* tendency mentioned above.

D. CONCLUSION

Analysis is made of dominant Szondi trends for 88 14- to 16-year-old adolescents in the light of similar data on 200 seven-year-old children. These differences are interpreted as reflecting the greater degree of self-control, insight, and capacity for sublimation of the 14- to 16-year-old and are related to other general developmental trends in personality.

Some differences in Szondi trends between the sexes in the 14- to 16-year-old group are also discussed and related to differential developmental factors.

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ANDERSON'S OVERLAP-HYPOTHESIS AND THE DISCONTINUITIES OF GROWTH*

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J. E. Anderson (1, 2) bases his so-called "overlap-hypothesis" on an interpretation of coefficients of correlation in terms of common elements. The data to which he applies this model are the correlations between intelligence test scores of the same group at different age levels. The present investigation arose from the fact that the overlap-hypothesis yields predictions which deviate rather systematically from the observed data. It will be our task to derive a rationale for these deviations and thus to transform the shortcomings of the original hypothesis into sources of new insight.

If two events (*A* and *B*) can be thought of as being due to a number of equally potent, equally likely, and independent elements (*N*) then it can be shown that the correlation between these two events is a function of three parameters: the number of elements in A (N_a) and in B (N_b), and the number of common elements (N_{ab}). The correlation between *A* and *B* is thus given by:

$$r_{ab} = \frac{N_{ab}}{\sqrt{N_a \cdot N_b}} \tag{1}$$

Darbishire's (4) dice experiments, as reported by Pearl (12), have provided us with a paradigm for this relationship.

In order to apply this model to intellectual growth data Anderson had to make a rather bold assumption, which we shall accept in view of the lack of a better one.[1] He equates the mean mental ages (in months) of a group with the number of elements accounting for the mean performance of that group at a given age level. The values N_a and N_b thus correspond to the mean *MA*'s at the ages *A* and *B* respectively.

A few substitutions will ease our procedure which presently intends to show that Anderson treated a special case of the general model only. We put:

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[1] Our acceptance of this assumption is at the moment only tentative. The authors feel, however, that their investigation lends considerable support to Anderson's assumption.

$$(2) \qquad N_a \leqslant N_b;\ \text{thus: } N_a = p \,.\, N_b \ \text{for: } p = \frac{N_a}{N_b} \leqslant 1.00$$

$$(3) \qquad N_{ab} \leqslant N_a;\ \text{thus: } N_{ab} = k \,.\, N_a \ \text{for: } k = \frac{N_{ab}}{N_a} \leqslant 1.00$$

Equation (1) thus changes to:

$$(4) \qquad r_{ab}{}^2 = \frac{K^2 \,.\, p^2 \,.\, N_b{}^2}{p \,.\, N_b{}^2}$$

and

$$(5) \qquad r_{ab} = k \,.\, \sqrt{p}$$

The meaning of the two parameters *k* and *p* can be readily obtained:

$p = \dfrac{N_a}{N_b}$ is what Anderson calls the "overlap" of the two mean *MA*'s;

$k = \dfrac{N_{ab}}{N_a}$ becomes 1.00 if and only if $N_{ab} = N_a$; i.e., when all the elements accounting for the performance at the lower age level also operate at the higher age level. Anderson tacitly assumed that to be the case and therefore gave his overlap equation the form of

$$(6) \qquad r_{ab} = \sqrt{p}$$

This simple square root law presupposes a value of 1.00 for the parameter *k*; it will thus overestimate the correlations r_{ab} in all those instances where *k* is smaller than 1.00. Values of *k* less than unity may however always occur when some of the elements that accounted for the performance at the lower age level have subsequently ceased to operate or have not been elicited by the tests administered at the higher age level. The present investigation is primarily concerned with the values of *k*, that is, with the phenomenon of the dropping out of developmental factors in the course of growth. It seems that this aspect of development has been somewhat overshadowed by the oversimplified conception of growth as a process of increase.

The general case of the overlap model and two special cases are represented in Figure 1. Case 2 is the one considered by Anderson. Case 3 applies to the correlation between two administrations of the same test at (roughly) the same age level, i.e., to the reliability of the test. We shall return to this relationship in a moment.

It has been mentioned that Anderson's equation (6) will overestimate the values of r_{ab} whenever k is less than unity. This has indeed been the case in the three studies (1, 11, 13) which have so far used the overlap-hypothesis. As an illustration we shall avail ourselves of the Harvard Growth Study (5), or more specifically the sample of 135 boys and 130 girls taken by Anderson from the files of Dearborn and his co-workers. Figure 2 presents r_{tx} as a function of p_{tx}.[2] The broken lines give us an idea of the magnitude of the parameter k. Its values range between 0.72 and 0.94. The mean of k_{tx} amounts to 0.87 for the male group and to 0.85 for females. From Figure 2 one obtains, however, the impression that k_{tx} is actually not a constant—allowing for some random fluctuations—but that its value undergoes some systematic changes. This can be more readily seen from Figure 3, in which k_{tx} has been plotted as a function of the chronological age of the subjects. The most conspicuous feature of the graphs is the drop of k_{tx} which corresponds to an age of 9.4 years in both sexes. The values of k_{tx} are obtained from the equation:

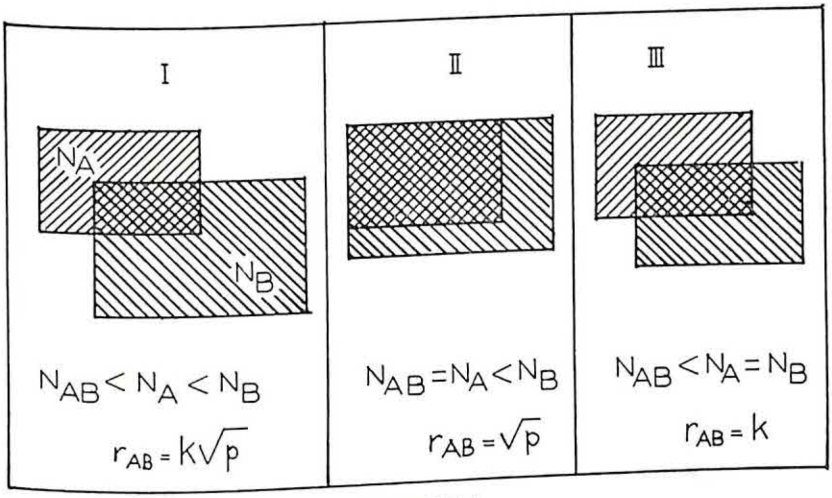

FIGURE 1
THE THREE CASES OF THE OVERLAP MODEL

$$k_{tx} = \frac{r_{tx}}{\sqrt{p_{tx}}} \qquad (5')$$

Anderson was, of course, aware of the fact that his square root law (6)

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[2] The subscripts refer to the terminal age (t) of the study (16.4 years) and to earlier ages (x). The subscript i which will be used later refers to the initial age (7.4 years).

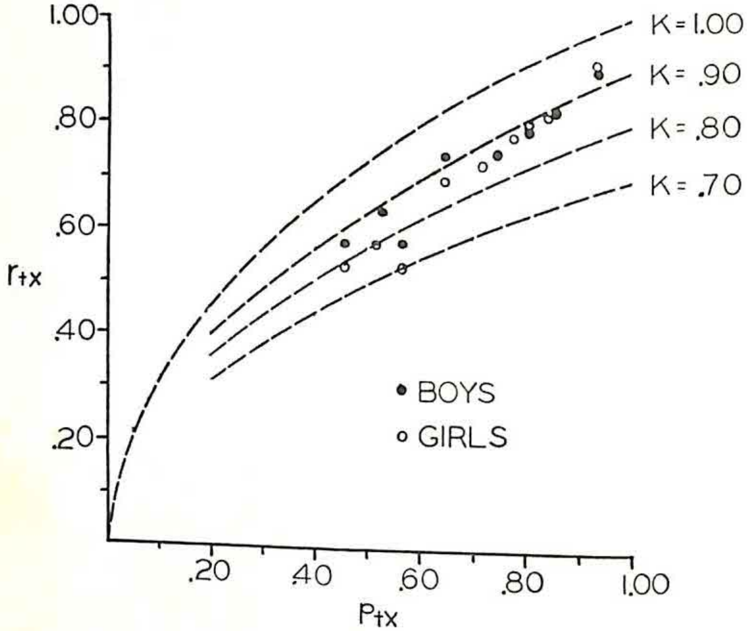

FIGURE 2
THE CORRELATIONS WITH THE TERMINAL SCORE AS A FUNCTION OF THE AMOUNT OF OVERLAP

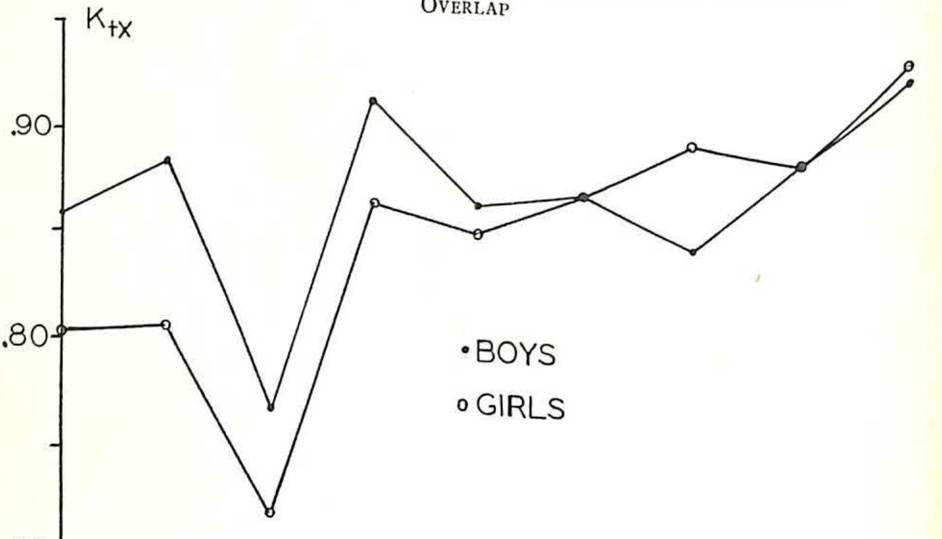

FIGURE 3
THE PARAMETER k_{tx} AS A FUNCTION OF AGE

overestimates the correlations (r_{tx}) and he has therefore suggested that the correlations should be corrected for attenuation, i.e., that the less than perfect reliabilities (r_{xx} and r_{tt}) of the tests should be taken into consideration. This suggestion amounts to the recognition of Case 3 of the general model; it introduces the hypothesis:

$$k_{tx} = \sqrt{r_{tt} \cdot r_{xx}} \tag{7}$$

Unfortunately, the reliabilities of the *MA*'s are not available for the Harvard Growth study; one might, however—as Anderson did—assume them to vary between 0.85 and 0.95. Since it is hardly feasible to correct the r_{tx}-values for attenuation unless the exact reliabilities are known no direct test of the relationship (7) seems possible. One may, however, take another approach which will show that the hypothesis in Equation (7) is not tenable. Assuming that Equation (7) holds we can obtain several estimates of the reliability r_{tt} which should, of course, fall into a narrow range of variation.

We proceed by means of the following assumed equations:

$$k_{tx}^2 = r_{tt} \cdot r_{xx} \tag{7'}$$

$$k_{it}^2 = r_{tt} \cdot r_{ii} \tag{8}$$

$$k_{ix}^2 = r_{ii} \cdot r_{xx} \tag{9}$$

From these we obtain:

$$r_{tt} = \frac{k_{tx}}{k_{ix}} k_{it} \tag{10}$$

By means of the relationship (10) we can obtain an estimate for r_{tt} from each age level (x), excluding the initial (i) and the terminal (t) level. Altogether eight estimates can thus be computed. Table 1 shows the results of this procedure. The estimates of the reliability of the terminal *MA* (r_{tt}) vary for boys between 0.84 and 0.97, for girls between 0.82 and 0.93. It seems unlikely that this spread could be due to chance alone. The chi-square test for the significance of differences between correlations[3] is not strictly applicable to our problem, since the estimates of r_{tt} are not independent. The test is therefore likely to underestimate the significance of the differences between the estimates. The obtained values of $X^2 = 65.92$ for boys, and

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[3] Cf. Edwards (6, p. 135): $X^2 = \Sigma[(n-3)\ z^2] - \dfrac{[\Sigma(n-3)\ z]^2}{\Sigma(n-3)}$.

$X^2 = 34.97$ for girls, are therefore rather too low than too high. They are, however, with seven degrees of freedom, sufficient to reject the hypothesis that the different estimates of r_{tt} are samples from a common universe at the 0.001 level of confidence. Anderson's suggestion that his square-root law would hold for corrected correlations seems therefore unacceptable.

TABLE 1

ESTIMATES OF THE RELIABILITY OF THE TERMINAL *MA* SCORE

Age (years)	Boys ($k_{it} = 0.856$)			Girls ($k_{it} = 0.802$)		
	k_{ix}	k_{tx}	r_{tt} (est.)	k_{ix}	k_{tx}	r_{tt} (est.)
7.4		0.856			0.802	
8.4	0.784	0.885	0.966	0.696	0.807	0.930
9.4	0.773	0.767	0.849	0.674	0.723	0.861
10.4	0.864	0.920	0.912	0.855	0.871	0.817
11.4	0.851	0.871	0.876	0.817	0.859	0.843
12.4	0.850	0.878	0.884	0.856	0.879	0.824
13.4	0.871	0.853	0.838	0.853	0.904	0.850
14.4	0.891	0.894	0.859	0.859	0.894	0.835
15.4	0.865	0.929	0.919	0.815	0.935	0.920
16.4	0.856			0.802		

We would have arrived at the same result, that is the rejection of equation (7), by simple inspection of Figure 3. At the age of 9.4 years k_{tx} drops suddenly in both sexes. If we assume that Equation (7) holds we have to ascribe this phenomenon to a drop in the reliability of the test employed at that age level. It is, however, hard to see why this test should be so much less reliable than the tests for the adjacent age levels of 8.4 and 10.4 years.

On the basis of the foregoing discussion we come to the conclusion that our parameter k_{tx} reflects at least two phenomena: variations in the reliabilities of the tests and the occasional dropping out of elements which have so far been operating in the performance of the subjects. The parameter k_{tx} thus becomes an indicator of discontinuities of development. It seems that such a discontinuity exists in the intellectual development of both sexes at an age of approximately 9.4 years. The essence of this discontinuity can only be guessed; a plausible suggestion is, that children at that age change their frame of reference temporarily and thus view the tests and the testing situation in a different light than either before or after. We shall later present a set of data which affords us a better chance to infer the essence of an abrupt discontinuity.[4]

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[4] In view of the fact that the Harvard Study used different tests at the different age levels the possibility can, of course, not be ruled out that the drop of k_{tx} at the age of 9.4 years is due to the test rather than to changes on the part of subjects.

We may, however, first take a look at Honzik's and her co-workers longitudinal study (10) which involves a population of 250 children that have been tested from an initial age of 21 months up to 18 years. Since the mean *MA*'s of the children are not given in this study we shall have to follow a procedure suggested by Honzik (9) and substitute the mean chronological ages (*CA*) for the *MA*'s in the computation of the overlaps p_{ix} and p_{tx}. The age level of 18 years has been left out because it is well known that the proportionality of *MA* to *CA* becomes doubtful after an age of 15 years. The substitution of the ratio $\frac{CA_x}{CA_t}$ for the ratio $\frac{MA_x}{MA_t}$ as defining p_{tx} is, of course, in itself a possible source of error. This will have to be kept in mind when some of our k_{tx}-values turn out greater than unity. Table 2

TABLE 2
THE PARAMETERS k_{ix} AND k_{it} IN THE CALIFORNIA STUDY

Age (mo.)	p_{ix}	r_{ix}	k_{ix}	p_{tx}	r_{tx}	k_{tx}
21				0.125	0.07	0.20
24	0.875	0.71	0.76	0.143	0.21	0.56
36	0.583	0.52	0.68	0.214	0.35	0.76
48	0.438	0.38	0.57	0.286	0.51	0.95
60	0.350	0.39	0.66	0.357	0.61	1.02
72	0.291	0.27	0.50	0.429	0.67	1.02
84	0.250	0.29	0.58	0.500	0.73	1.03
96	0.219	0.27	0.58	0.571	0.85	1.13
108	0.194	0.26	0.59	0.643	0.87	1.08
120	0.175	0.22	0.53	0.714	0.85	1.01
168	0.125	0.07	0.20			

presents an analysis of the California data. A glance at the two columns k_{ix} and k_{tx} immediately reveals that these are not constants in the course of development; these values are, for the most part, not in agreement with the tacit assumption of Anderson's square root law (6); that is, with the assumption of $k_{tx} = 1.00$. In the present case we can, however, go one step further and offer what seems to be a very plausible suggestion for the interpretation of *k*. We proceed by means of a factorial analysis of the California data, which can be resolved into two independent factors. Table 3 presents the correlations between intelligence scores at different age levels and the loadings of the two factors (II and III); these are presented in their orthogonally rotated form.[5]

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[5] A parallel analysis of Bayley's (3) set of developmental correlations has already been carried out by one of the present authors (8). The agreement between the two studies is very good if we restrict Bayley's data to the age range from 21 months

Figure 4 gives a plot of the augmented factor loadings[6] obtained from two sets of correlations, Honzik's and Bayley's against *CA*. The agreement of the two trends is indeed rather impressive. The third set of curves in Figure 4 are the values of k_{ix} and k_{tx} as obtained from Honzik's study in Table 2. Particularly with regards to k_{tx} there can be little doubt that the developmental course of this parameter parallels the course of Factor III. The parallel between k_{ix} and Factor II is less impressive but still suggestive.[7]

TABLE 3
FACTORIAL ANALYSIS OF THE INTER-AGE CORRELATIONS OF THE CALIFORNIA STUDY
(DECIMAL POINTS OMITTED)

Age (mo.)	24	36	48	60	72	84	96	108	120	168	Factor loadings II	III	h^2
21	71	52	38	39	27	29	27	26	22	07	76	11	59
24	—	69	46	32	47	46	43	45	37	21	81	24	71
36		—	58	57	57	55	49	53	36	35	72	38	66
48			—	72	62	59	61	59	66	54	48	60	59
60				—	71	73	70	68	75	61	36	73	66
72					—	82	77	80	71	67	31	80	74
84						—	83	82	77	73	28	85	80
96							—	91	88	85	22	92	89
108								—	90*	87	21	94	93
120									—	85	15	93	89
168										—	00	91	83

*Estimated by the present authors.

We thus arrive at the conclusion that the parameter *k* corresponds to loadings of the factors which predominantly account for the performance at the initial age level (k_{ix}) and at the terminal age level (k_{tx}) respectively. The parameters k_{ix} and k_{tx} may thus be assumed to be indeed close to unity (or the geometric mean of the reliabilities involved) if the factorial composition of the test performances remains unchanged between the initial and the terminal age levels. Only in this case would Anderson's simple square root

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upward. Inclusion of the earlier age levels of Bayley's study (2, 5, 8, 11, and 14 months) reveals however the operation of a third factor that drops out at the end of the second year. It is for this reason that the factors in the present study have been labeled II and III.

[6] Augmented factor loadings (a^*_{xF}) correct for the differences in the communalities (h^2) of the variables by means of the relationship:

$$a^*_{xF} = \frac{1}{h} a_{xF}$$

Cf. Guilford (7, p. 496).

[7] A content interpretation of the two factors is not the task of the present paper. The interpretation given in the analysis of the Bayley data (8) seems however still acceptable. Factor II has been labeled as "persistence," Factor III as "manipulation of symbols." Factor I of the Bayley study which dominates the first 18 months of life has been referred to as "sensori-motor alertness."

law (6) hold. This is, however, not the most regular case in developmental sequences.

We shall now turn to a set of developmental data which is less beclouded by questions of reliability than are intelligence data. We refer to the Harvard Growth Study as reported by Shuttleworth (14) and in particular to the measures of stature which are given for the ages from 6.0 through 18.0 years (for two groups of boys) and from 6.0 through 16.0 years (for two groups of girls). In Figure 5 the values of k_{tx} have been plotted against *CA*.[8] The troughs occur in the female sex at an age of 11.5 years approximately and in the male sex at an age of 13.5 and 14.5 years. There can be no doubt that this behavior of k_{tx} reflects pubertal changes of the growth pattern. The meaning one has to attach to this finding is, obviously, that during puberty growth in stature is in part due to factors which do not contribute to the growth in stature either before or after puberty. Shuttleworth (p. 66, 67) points at "endocrine or pituitary stimulation." It remains interesting

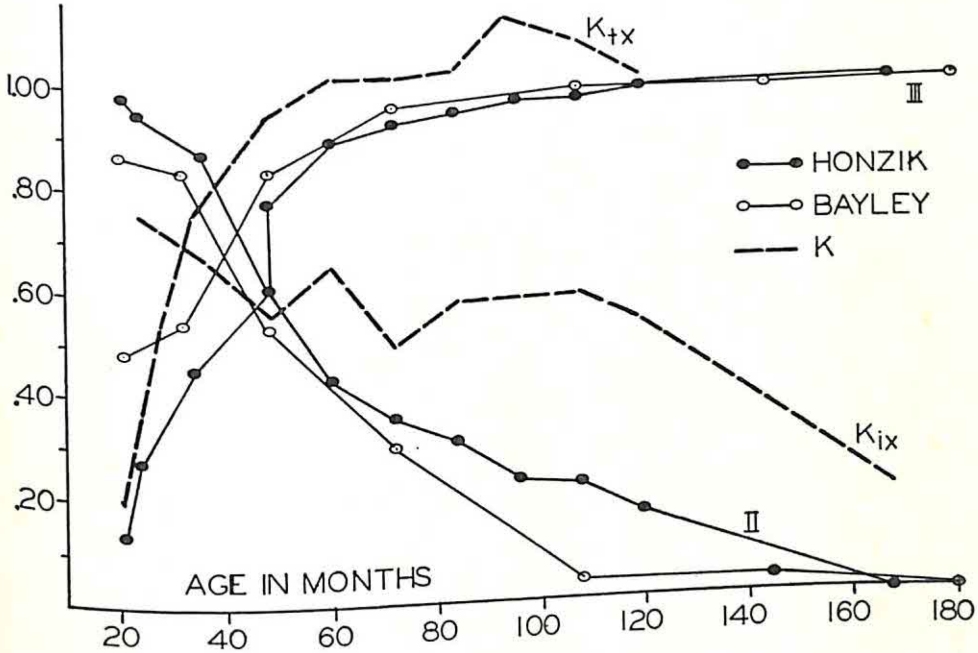

FIGURE 4
THE DEVELOPMENTAL TRENDS OF THE FACTOR LOADINGS OF TWO STUDIES AND OF THE PARAMETERS k_{ix} AND k_{tx}

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[8] The overlap (p_{tx}) was computed from the mean statures at the age levels x and t.

that the pubertal discontinuity is in this case more marked in the male sex than in the female.

The reference to body growth serves two purposes in the context of our discussion. In the first place it seems to lend support to the general assumption that subsequent stages in a developmental series can be represented by different "numbers of elements" and their overlap. The second point which can no longer be considered doubtful is that the smaller scores (at lower ages) contribute in varying amounts to the pool of "common elements." The correlations between the age scores (x) and the terminal score (t) become thus functions of two parameters, i.e., the amount of overlap (p_{tx}) and the degree to which smaller scores become parts of the terminal score (k_{tx}). Anderson's original overlap hypothesis recognized only one of these parameters (p_{tx}) and thus assumed the other (k_{tx}) to be a randomly fluctuating constant equal to the geometric mean of the involved reliabilities. Our own investigation has taught us to consider k_{tx} as a parameter which undergoes systematic changes in the course of development. The fact that critical phases in development reflect themselves in rather sudden drops of k_{tx} points to changes in the factorial composition within a growth series.[9]

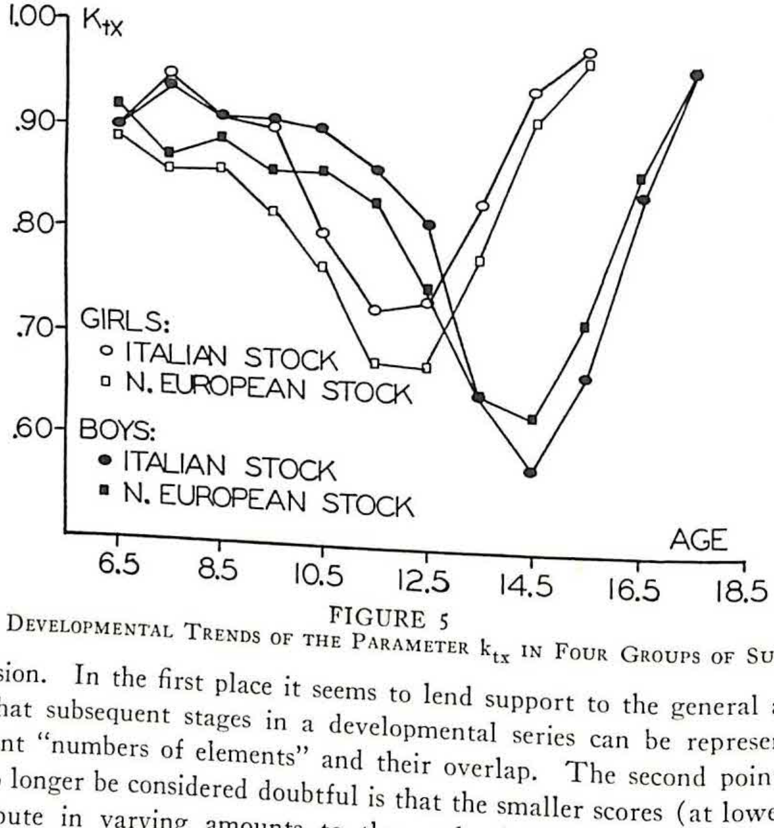

FIGURE 5
THE DEVELOPMENTAL TRENDS OF THE PARAMETER k_{tx} IN FOUR GROUPS OF SUBJECTS

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[9] The corresponding values of p_{tx} are almost identical for the four groups; they fall between 0.89 and 0.93.

In mental growth we have found two possible behaviors of k_{tx}: a steady increase on the one hand (Figure 4) and a sudden drop on the other (Figure 3). The latter case is somewhat doubtful because of changes in the tests used at different age levels in the Harvard Growth Study. It is only in the light of our analysis of body growth that we tentatively entertain the hypothesis of a prepubertal critical phase in mental development. However this may be, it seems that the neglected *k*-term of the original overlap-hypothesis furnishes us with a valuable tool for the analysis of growth processes. The parameter *k* is an indicator of the amount of continuity (or discontinuity) in a developmental series.

SUMMARY

1. Reconsideration of Anderson's overlap hypothesis ($r = \sqrt{p}$) shows it to be a special case of the more general relationship $r = k\sqrt{p}$.

2. The *k*-term in this equation—assumed by Anderson to be equal to unity or, at least, equal to the geometric mean of the involved reliabilities—is shown to be an independent parameter which indicates the amount of continuity (or discontinuity) in a developmental series.

3. Discontinuities as measured in terms of *k* can either be sliding or abrupt. An abrupt discontinuity has been demonstrated in the process of body growth during puberty; another has been tentatively identified in mental growth during prepuberty. A sliding discontinuity was found in Honzik's and her co-workers longitudinal data.

4. Factorial analysis of Honzik's data reveals a close parallel between the loadings of two factors for the different age levels and the respective values of *k*.

5. Anderson's hypothesis that the ratio of the scores in a developmental series (such as *MA*'s or measures of body height) gives the overlap between these scores in terms of common elements is supported.

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DISCRIMINATION LEARNING AND DISCRIMINATION REVERSAL LEARNING IN NORMAL AND FEEBLEMINDED CHILDREN*

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A. PROBLEM AND PURPOSE

The meaning of mental age and the possibility of significant qualitative differences between average and feebleminded individuals having the same mental age have long interested psychologists. Lewin (4) and Kounin (2, 3) have postulated that a major difference between a feebleminded individual and a normal child of the same degree of differentiation (same Mental Age) consists of a functional rigidity which causes the feebleminded person to cling to a fixed goal or habit and which makes it more difficult for him to evaluate new situations. If this theory is correct, one would expect that in a situation which requires a change from an established habit to a new habit, the feebleminded individual would have greater difficulty than the average individual in changing. In particular, in a discrimination reversal learning situation (1) feebleminded subjects should cling to the formerly correct choice and thus should perform more poorly on the reversal problems than subjects of average intelligence. The latter would presumably show high positive transfer from the original learning to the reversal learning.

To test this assumption, two groups of 30 children with insignificant differences in mental age were selected. One group, the control, was composed of children who tested in the average and superior range on the 1937 revision of the Stanford-Binet, Form *L*; they were enrolled in an elementary school in Berkeley, California. The experimental group was composed of children who tested in the moron range (*IQ* 50-69) on the Stanford-Binet scale. The experimental children were from a Canadian government school for retarded children in Vancouver, British Columbia.

The control and experimental groups were each divided into two subgroups similar in *CA, MA,* and *IQ* and each of the four resulting groups was trained in a series of discrimination learning problems. After reaching the criterion of learning, subjects returned to their classes. On the day

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following the discrimination training half the normal children (Group I) and half the feebleminded children (Group III) were trained with a new but similar set of pairs of stimuli in a discrimination reversal problem. The training in discrimination reversal was delayed for six weeks for the other half of the subjects.

TABLE 1

		Normal subjects		Feebleminded subjects	
		Group I 24 hour reversal	Group II 6 week reversal	Group III 24 hour reversal	Group IV 6 week reversal
N		15	15	15	15
MA	*M*	69.73	66.40	71.00	68.80
	SD	4.81	4.56	6.44	4.07
CA	*M*	62.07	62.53	127.73	128.60
	SD	1.48	2.24	10.30	10.80
IQ	*M*	112.33	107.73	55.73	53.20
	SD	6.64	10.98	4.84	1.80

It was hypothesized that (*a*) feebleminded subjects would show more errors in learning the original discrimination problems, (*b*) less forgetting once the criterion was reached, and (*c*) more errors in learning the discrimination reversal problems. The first and third hypotheses are based on the assumption that feebleminded individuals are more "rigid" and hence will show less positive transfer from situation to situation than normals. The second hypothesis is based on Kounin's (4, 5) assertion that feebleminded individuals will perform better than equally "differentiated" normals on tasks which are facilitated by lack of communication between "regions." To the extent that forgetting is dependent on interference one would expect less interference as a result of extraneous experience in the case of the feebleminded. The difference ought to be especially marked in the case of the six-week groups.

B. MATERIALS AND PROCEDURE

The stimuli used in this study were a series of pairs of pictures. No two pictures were the same. The pictures were inserted into slots in a movable frame behind which was a concealed reward trough. The child was instructed to select one of the two pictures by pushing the card, and if the correct card was chosen the child found a reward (small charms purchased at novelty counters) in the trough behind it. If the wrong card was chosen, no reward was found. The non-correction method was used throughout. The child was given six trials on each pair of pictures. After six trials a new pair was presented. New pairs were continued until the child reached a criterion of five correct trials after the initial trial on three successive pairs of pictures and was capable of verbalizing the solution. The first trial on the initial problem for all subjects was unrewarded in an attempt to minimize the effect of first trial success and position preferences. The position of the cards was varied in a predetermined order.

The procedure in reversal learning was to have the children respond as previously on a discrimination problem for a varied number (5 to 8) of trials and then to change the rewarded card for six trials. The number of trials on the discrimination problem was varied so that the reversal could not be anticipated correctly on the basis of the number of previous trials. These discrimination reversal problems were continued until the subject reached a criterion of five correct trials after the initial reversal trial on three successive problems.

C. Results

1. *Discrimination Learning*

Reference to Table 2 shows that in the original learning there were no significant differences among the four groups in the number of problems required to reach the criterion. There is just the slightest tendency for the number of errors, and consequently the number of errors per problem, to be greater in the feebleminded groups, but the most reasonable conclusion appears to be that the first hypothesis is not confirmed.

TABLE 2
Discrimination Learning

		Normal subjects		Feebleminded subjects	
		Group I 24 hour reversal	Group II 6 week reversal	Group III 24 hour reversal	Group IV 6 week reversal
Problems to reach criterion	*M*	11.46	12.73	12.87	12.33
	SD	4.64	6.38	4.76	5.56
Errors to reach criterion	*M*	21.86	24.80	27.40	27.40
	SD	12.86	16.91	12.91	15.46
Errors/problem to reach criterion	*M*	1.91	1.95	2.13	2.22
	SD	.38	.41	.37	.50

2. *Forgetting*

It can be seen from the first row of Table 3 that there are no differences of any consequence between the four groups with regard to the number of errors made on the discrimination problem on the second day. That is, on the first problem of the second session—before the subjects had experienced any reversals, normal and feebleminded subjects performed equally well. The second hypothesis predicted that feebleminded subjects would suffer less interference and hence perform better than normals. No such evidence has been obtained.

TABLE 3
DISCRIMINATION REVERSAL LEARNING

		Normal subjects		Feebleminded subjects	
		Group I 24 hour reversal	Group II 6 week reversal	Group III 24 hour reversal	Group IV 6 week reversal
Errors on problem preceding reversal	*M*	.72	.91	.45	.94
	SD	.65	.39	.33	.78
Problems to reach criterion	*M*	4.40	4.40	4.20	6.27
	SD	1.58	1.17	1.72	1.14
Errors to reach criterion	*M*	6.93	6.67	7.20	13.13
	SD	5.72	6.84	3.83	4.70
Errors/problem to reach criterion	*M*	1.58	1.52	1.71	2.09
	SD	.62	.48	.63	.49

3. *Reversal Learning*

The remainder of Table 3 shows that Group IV (Feebleminded, six-week interval) did significantly worse than the other three groups with respect to the number of reversal problems required to reach the reversal criterion. An analysis of variance shows no significant difference between the total feebleminded group and the total normal group nor between the combined 24-hour reversal group and the combined six-week reversal group on the average number of reversal sets needed to reach the reversal criterion, but there is a significant interaction *F* ratio. Thus the third hypothesis is only partially confirmed, since only one of the feebleminded groups shows the predicted difficulty in learning the reversal problems. This is interpreted as meaning that the combination of low *IQ* and a long interval between original learning and reversals had a deleterious effect on reversal learning. Group IV also made significantly more errors in reversal learning than did the other groups, but this difference is perhaps an artifact of the greater number of problems given this group since there was no significant difference between groups in the average number of errors per reversal problem.

D. DISCUSSION

The most obvious generalization concerning these data is that for the problems involved there is little difference between normal and feebleminded subjects despite the great differences in chronological age and *IQ*. Mental age appears to be a rather good index of the abilities called for. However, the differential effect of time on the two groups does seem to call for some interpretation. One possibility is that the more abstract the problem at hand the greater the degree to which it is forgotten by feebleminded individuals. One might speculate that in the original discrimination learning two processes occurred: the subjects learned the solution to the particular problems, and they learned how to learn (that is, they learn to vary the mode of attack, to disregard irrelevant aspects of the situation and the like). This second; more abstract aspect of the original learning is presumably the aspect that suffers from the effects of time. If one accepts this dual process notion as plausible he can hardly argue that feebleminded subjects fail to learn to learn in the first place for Group III (the feebleminded, reversal after one one day) learns the reversal as well as the normals. Furthermore, both feebleminded groups show a large degree of positive transfer.

While this "explanation" is little more than a description it at least has the merit of being testable. Problems of varying degrees of abstractness could be set up and the effect of intervening time determined. Presumably, the more abstract the problem the greater the advantage of normals as compared with the feebleminded.

E. SUMMARY

Thirty normal and 30 feebleminded subjects with equivalent mental ages were trained in a series of discrimination learning problems. One-half of the normals and one-half of the feebleminded were then trained in discrimination reversals 24 hours after the original training, while the other half of each group was trained in reversals after six weeks.

There were no significant differences among the four groups in learning the original discrimination problems, nor were there significant differences in remembering them. Feebleminded subjects who underwent discrimination reversal training six weeks after the original discrimination learning learned the reversal problem less easily than other groups. Both normal and feebleminded subjects showed a large degree of positive transfer from the discrimination problems to the discrimination reversal problems.

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SPATIAL LEARNING FROM DIFFERENT POSITIONS IN A ROOM*

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A. The Problem

The present experiment was designed to test the effect on spatial learning of a 90-degree maze rotation subsequent to the learning of the maze on one axis. In attempting to strengthen and formulate more clearly Tolman's "expectancy theory" as it pertains to spatial learning, Tolman, Ritchie, and Kalish (3) instituted the first of a series of studies to this end. In this investigation they give their definition of "expectancy" as being such that: "When we assert that a rat expects food at location *L*, what we assert is that *if* (*a*) he is deprived of food, (*b*) he has been trained on path *P*, (*c*) he is now put on path *P*, (*d*) path *P* is now blocked, and (*e*) there are other paths which lead away from path *P*, one of which points directly to location *L*, *then* he will run down the path which points directly to location *L*." They continue: "When we assert that he does *not* expect food at location *L*, what we assert is that, under the same conditions, he will *not* run down the path which points directly to *L*" (p. 15).

In testing the above hypothesis Tolman, Ritchie, and Kalish trained 56 rats for four days on an apparatus in which food was always found in the *same place*. On the fifth day they were tested on an apparatus with 18 pathways through an arc of 180 degrees. Pathway 6 on the test apparatus pointed directly to the former location of food. Of the 53 animals making a choice in six minutes, 36 per cent chose Pathway 6, the pathway leading to the location of food during training. The authors conclude: ". . . rats do learn to expect goals in specific locations."

However, in attempting to duplicate these results, Gentry, Brown, and Kaplan (1) were unable to obtain results which were favorable to the spatial-learning hypothesis. They conclude: ". . . since our results for both the animals with training and without training are in part explainable in terms of an artifact of the experimental apparatus (the presence of *Alley CD*), we wonder if their results are not explainable in terms of some artifact of their experimental setup, and hence if there is any need for them to appeal to the senior author's expectancy theory in its inferential form" (p. 322).

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[1] The cost of this study was met in part by a grant to the senior author by the Research Institute of The University of Texas.

In an experiment designed to test spatial learning on a test trial following the learning of a multiple-*T* maze, Gentry, Brown, and Lee (2) trained rats for 11 days to cross an 18-inch circular starting table and run an eight-cul elevated maze. On the test trial, at which time 10 three-foot pathways were placed radially about the starting table, the rats found the approach to the first choice point blocked. A 7.5-watt light, which had been directly behind the food-box during training, was still in its former location and shining directly down one of the new pathways which had been inserted. According to the "expectancy theory," the light should have been a factor in determining subsequent performance. But the investigators found that only 5 per cent of the animals chose the path which led directly towards the light and the position of the food-box in preliminary training. On the basis of these results, it was concluded that: "The animals in this experiment exhibited no evidence that the light was a factor or that a general directional orientation with reference to the locus of the goal-box was operative" (p. 318).

In a further attempt to present "direct" evidence that what the rat learns in a *T*-maze situation "is not a disposition to make certain responses" but "rather a disposition to orient towards, or go towards, the goal." Tolman, Ritchie, and Kalish (4) designed an experiment which allowed them to separate and distinguish the disposition to turn right as against the disposition to go towards the location of the goal. In order for the maze to be learned, one group of eight rats was required always to make a right turn, whereas another group of eight animals was required to go always to a constant food location. On the basis of the results obtained, the authors concluded: that ". . . both kinds of dispositions may be acquired by the rat, but that the disposition to orient towards the goal is simpler and more primitive than the disposition to make right turns" (p. 228).

B. MATERIAL AND EXPERIMENTAL PROCEDURE

1. *Maze and Room*

The maze set-up used in this experiment consisted of two elevated maze units which were of different lengths, but of the same height, width, and color. The shorter unit was 15 inches high, 2 inches wide, and 24 inches long. The longer unit was 84 inches in length, 15 inches high, and 2 inches wide. Both units were constructed of pine painted black. The units were wiped with a damp cloth each day before being used to prevent possible "tracking." The 84-inch runway had a detachable tin cup countersunk at one end. This attached food cup occupied the same position in the room on all trials, regardless of the axis (north to south or east to west) on which the maze was placed. The 24-inch unit always approached the main runway at the same distance from each end so as to form the *T*-maze as presented in Figures 1a and 1b.

The experimental room was 18 feet square with a window on the north, east, and west, and a door on the south. The door was kept closed during training and all other spatial features of the experimental room were constant from day to day.

2. *Animals*

Eighteen experimentally naïve animals between 60 and 70 days old at the beginning of the experiment were used. They were descendants of the Wistar strain reared in the Comparative Psychology Laboratory of the University of Texas. These animals were not divided into groups *per se,* but were designated as Group I-A and Group I-B in that the same animals were presented two different problems.

3. *Feeding*

Two days before preliminary training began, the animals were placed on a 24-hour feeding schedule. During preliminary training the animals were allowed to eat a moist mash for about five minutes in a food box and then were returned to the home cage where they were given a small amount of dry food. But during training they were allowed to eat for approximately 25 seconds at the end of each trial, and were then returned to the home cage where they were given two additional pellets of Purina Dog Chow.

4. *Training and Test Procedure*

During preliminary training the animals were given two trials per day for six days on a 48-inch pathway in a room adjacent to the experimental room. During training and testing they were given four runs a day for 20 days between 2 P.M. and 5:30 P.M. For the first 10 days of training the animals were given four trials per day on the maze pattern presented in Figure 1a. These trials consisted of two trials from north to south and two from south to north. At the beginning of the second 10 days of training the maze was rotated 90 degrees, thus placing it on an east-west axis as depicted in Figure 1b. The animals were again given four trials per day for 10 days (two trials from east to west and two from west to east). The order of runs was varied in a randomized manner from day to day.

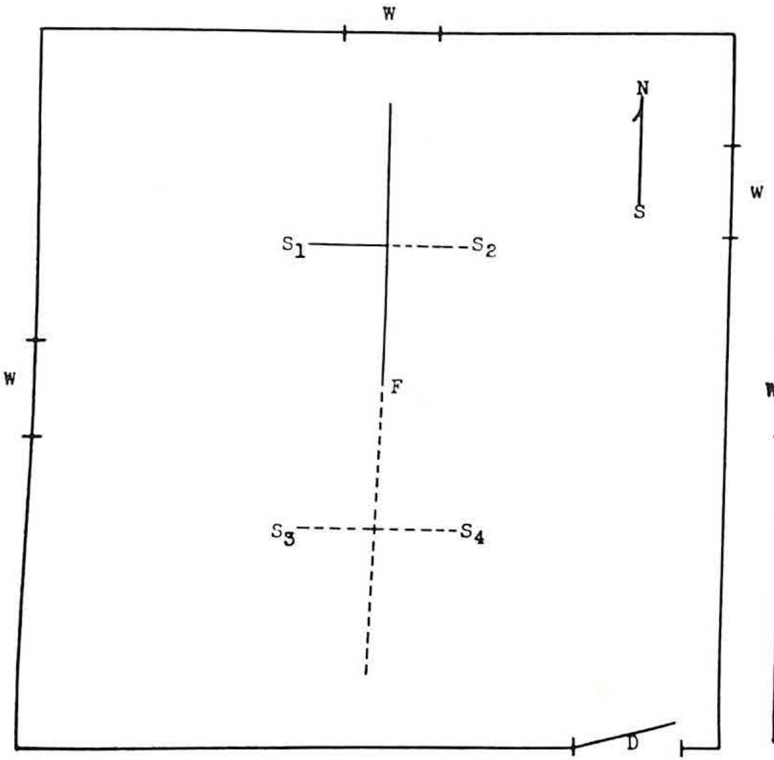

FIGURE 1a
FLOOR PLAN OF MAZE FOR GROUP I-A

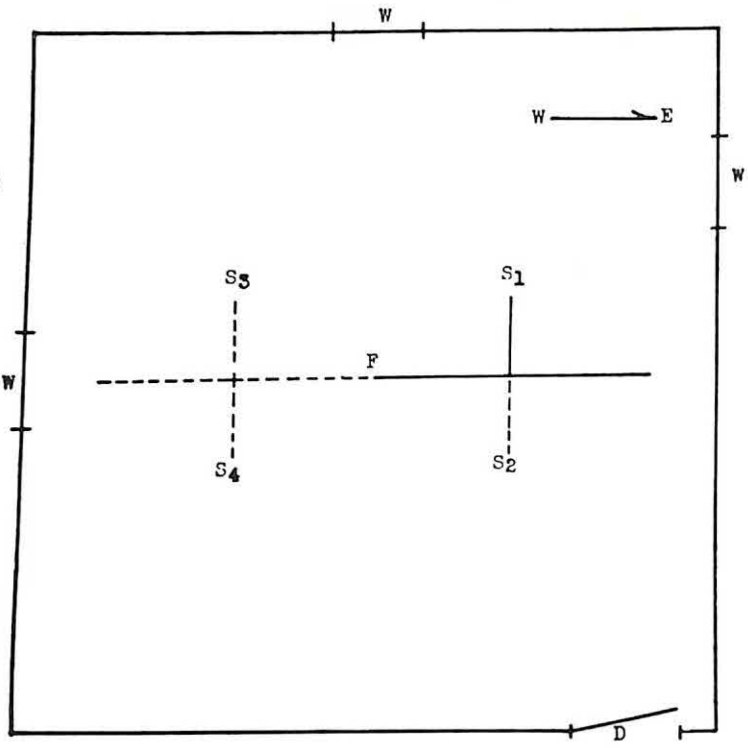

FIGURE 1b
FLOOR PLAN OF MAZE FOR GROUP I-B

The first day starting positions consisted of S_1, S_2, S_3, and S_4, as the series; the second consisted of S_2, S_1, S_4, and S_3, and so on for the full 20 days. In this way, the animals started each series of trials from the same starting position on only five days.

During this training period the experimenter stood directly behind the starting arm on each trial. After each series of trials the animal was returned to the home cages in an adjacent room. As was stated earlier, all animals were rewarded on all trials at the *same place* in the room.

5. *Scoring*

The non-corrective method was used and only one error per trial was recorded. The animal was considered to have made an error when half the length of the body passed a point 6 inches from the end of the cul.

C. RESULTS

The results for the two groups are presented graphically in Figure 2 and quantitatively in Tables 1 and 2.

Figure 2 shows the errors made for the first 10 days of training on the north-south axis and also for the 10 days of training on the east-west axis. A comparison of the errors made by Group I-A on the first day of training

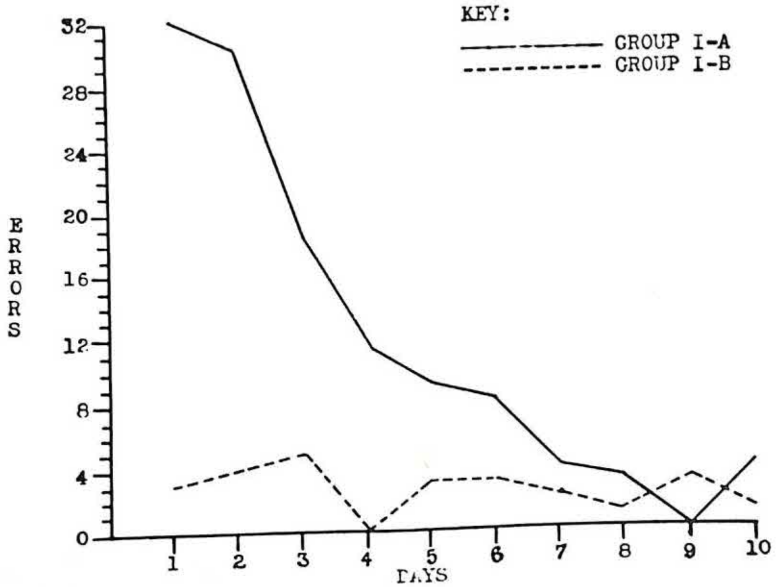

FIGURE 2
ERROR SCORE CURVE FOR GROUPS I-A AND I-B

as against the errors made by Group I-B on the first day of training presents a difference significant at the 1 per cent level of confidence (see Table 1). This difference is also shown for the first trials by the learning curves in Figure 2. A comparison of the total errors made by Group I-A with those made by Group I-B shows a difference beween means which is significant at the 5 per cent level of confidence (see Table 1). An examination of the statistics presented in Table 2 shows that the variance of performance within the maze positions of Group I-A is greater than the variance between positions, and that the obtained F-ratio is significant at neither the 1 per cent nor the 5 per cent level of confidence (see Table 2). Somewhat different results were obtained for Group I-B in that the variance between positions was somewhat greater than that within positions, but the derived F-ratio was likewise not significant at the 1 per cent or 5 per cent level of confidence.

TABLE 1

Table of t's for Error Scores

Training	First day Group I-B	Total training Group I-B
First day Group I-A	4.99	
Total training Group I-A		2.28

A t of 2.728 is significant at the 1 per cent level of confidence.
A t of 2.032 is significant at the 5 per cent level of confidence.

TABLE 2

Analysis of Variance for Maze Positions

	Between variance*	Within variance**	F ratio
Group I-A Positions	3.09	10.86	3.51
Group I-B Positions	2.22	.686	3.24

An F-ratio of 26.46 is significant at the 1 per cent level of confidence.

An F-ratio of 8.61 is significant at the 5 per cent level of confidence.

*— 3 degrees of freedom.
**—36 degrees of freedom.

D. Discussion of Results

The results of this study indicate that when the animals were given sufficient training on the maze presented in Figure 1a, they would perform at a level significantly above chance when placed on the maze pattern presented in Figure 1b. On the first day of training, the error score for Group I-A consisted of 32 errors, only four errors less than an absolute chance performance of 36 errors. But when the same animals, after 10 days of training on the maze pattern presented by Figure 1a, were placed on the same pattern after it had been rotated 90 degrees, their performance was significantly different at the 1 per cent level of confidence. The obtained *t* of 4.99 for the first day of training for each group indicated that there was a significant generalization of training from performance on the north-south axis to performance on the east-west axis. Since the maze was rotated 90 degrees, the change in the physical surroundings should, theoretically, influence the performance of the animals on the first day of training on the east-west axis, but the results indicate no such influence (if operating). While running from Positions 1, 2, 3, and 4 on the north-south axis the animals apparently generalized from some features of the physical environment, and this generalization facilitated their performance in running on the east-west axis. The experimenters are of the opinion that the animals ran away from the near wall at each bifurcation in the *T*-maze. If this hypothesis is true, then the animals should perform on any degree of rotation with an error score significantly different from the error score made the first day on the original training axis.

E. SUMMARY AND CONCLUSIONS

The foregoing study, designed to test the effect of a 90-degree rotation of the maze on subsequent maze performance, has demonstrated that:

1. There was a difference, significant at the 1 per cent level of confidence, of performance between Group I-A and I-B for the first day of training.

2. There was a difference, significant at the 5 per cent level of confidence, of performance between Groups I-A and I-B for total training.

3. Under the conditions obtained, there were no influences, significant at either the 1 per cent or 5 per cent level of confidence, operating to produce "loading" of errors on any given position.

4. The results indicate that the animals generalized from a north-south training axis to an east-west testing axis, and that this generalization was probably based upon the nearness of a wall to the bifurcation of the *T*-maze. Since the positions of the wall surfaces remain the same on both axes, we assume that they may have facilitated generalization of performance.

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UNCONDITIONED OPERANT BEHAVIOR IN TWO HOMOZYGOUS STRAINS OF MICE*

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A. INTRODUCTION

Schoenfeld, Antonitis, and Bersh (6) have recently reported on the character of the "operant level" or unconditioned rate of bar pressing by the albino rat in a Skinner type apparatus. They found ". . . (*a*) extinction-like trends in the unconditioned rate during each experimental hour; (*b*) a consistent decrease in mean number and variability of responses for the group with repeated sessions; (*c*) the final attainment of a stable operant level. . .". Some factors, noted by these authors, which may influence the rate of unconditioned responding are: (*a*) the kind of response, (*b*) the apparatus employed, (*c*) the species and age of the organism, and (*d*) external factors such as temperature. The unconditioned strength of operant behavior is also conceived of as a part of the general activity of the organism. The present experiment was designed to study two of these aspects of unconditioned responding: (*a*) the relationship between the unconditioned rate of emission of operant behavior and general activity, and (*b*) the effect of the genetic or species variable on the unconditioned rate of emission of behavior represented in general activity.

To study the activity-operant level relationship, it was reasoned that this relationship would be revealed if the response or class of responses measured were actually a part of the general activity of the organism. Accordingly, a test situation was developed which, it was believed, would provide a valid measurement of an activity sample in a manner closely analogous to that followed in measuring the operant level of bar pressing behavior in the rat (6).

To study the effect of genetic constitution on the unconditioned level of operant behavior represented in general activity, two distinct homozygous

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strains of mice were selected for comparison in the test situation devised. The two strains selected for study were the C57 Black and C-Scott Albino, since preliminary observations suggested that the two strains differed distinctly in levels of general activity in living cages. Previous work has demonstrated that general activity in the rat (5) and the specific activity of maze running speed in the mouse (7) are to some extent under the control of genetic variables.

B. SUBJECTS

Forty-eight male mice, 85-95 days of age on the first day of experimentation, were used. Twenty-four of these mice were of the homozygous C57 Black Subline 6 strain, and 24 of the homozygous C-Scott Albino strain.

C. APPARATUS

The test cage developed by Antonitis and Kish (1) for another purpose was modified for use in the present experiment. Only a brief description of the cage will be given here since a detailed description is available in the Antonitis and Kish (1) paper. The cage was a wooden box, 15 in. square and 6 in. deep on the inside. In the original version, the corners of the box were closed off with 6 in. wide grills to form small triangular compartments. Before one of the compartments, a trapezoidal-shaped recording platform was installed. This ¼ in. thick plywood platform rested on the leaf actuator of a microswitch, ⅛ in. above the floor. When the platform was depressed $\frac{1}{16}$ in, by 12 grams of weight, the microswitch was closed, activating the recording apparatus. Dummy platforms identical in size and shape with the recording platform were nailed to the floor of the cage before each of the other three corner compartments. In the modified version, opaque plywood panels were substituted for the grills forming the triangular corner compartments in the original version. During testing, the top of the box was covered with a pane of ⅛ in. thick glass, and on top of this a lightproof hood was placed. The interior of the test cage was painted with white enamel.

Recording equipment used included a moving tape kymograph to record the number and temporal spacing of platform depressions made by the *S* (subject) while moving about freely inside the test cage during test sessions. An electric clock with a sweep second hand was also used to cumulate the total time spent by the *S* upon the recording platform during the test session.

Four identical sets of apparatus were used to permit simultaneous testing of four *S*s. These were arranged side by side on two tables.

Except for the fact that the experiment was run with the room only dimly illuminated by light from a shaded goose-neck lamp some distance from the test cages, details of the experimental room and the housing of the subjects were identical with those of the previous study (1).

D. PROCEDURE

Fourteen days before the experiment was begun, the *S*s were placed in individual living cages. Food in the form of Purina Fox Checkers and water were always available in the living cages. Neither food nor water, however, were available in the test cages. These conditions were maintained throughout the experiment for all *S*s.

The subjects were run four at a time in the four test cages, two *S*s from the C57 group and two from the C-Scott Albino group being tested in each of 12 experimental cycles on each day. Both groups of *S*s were tested under identical external conditions. To counterbalance possible apparatus differences, *S*s were rotated regularly from one test cage to another on successive experimental days.

For each of six successive experimental days at the same time each day, each *S* was tested for 25 min. in total darkness in the apparatus. Total darkness as the condition of testing was chosen to eliminate possible differential depressant effects of light of any kind on the behavior of C-Scott Albino (unpigmented eye) and C57 Black (pigmented eye) subjects. While inside the test cage, the *S*s could roam freely about the octagonal floor. Whenever the *S* moved onto the recording platform, the switch under the platform was closed, starting the clock which cumulated the time spent on the platform, and activating a relay which made a mark on the kymograph tape. The switch under the platform opened, stopping the clock and returning the kymograph marker to normal position, when the *S* moved off the platform. After testing the *S* was immediately returned to its living cage. The test cages were thoroughly wiped out with a moistened cloth after each experimental cycle.

E. RESULTS

Group mean numbers of platform depressions and corresponding standard deviations for each of the six experimental days are presented in Table 1. The group means have been plotted against successive days in Figure 1. Table 1 and Figure 1 reveal that the C57 Black group emitted a greater mean number of platform depressions than the C-Scott Albino group on every day. The differences between the group means on each day were tested for significance with *t* tests. On Days 1, 2, and 3, the mean number of platform depressions of the C57 Black group is significantly larger than that of the C-Scott Albino group. The *t* values are respectively, 5.70, 3.43, and 2.46 with corresponding *P* values of $< .001$, .001, and .02. On Days 4, 5, and 6, the means of the two groups do not differ significantly. There were 46 degrees of freedom for all comparisons.

TABLE 1
MEAN TOTAL NUMBERS OF PLATFORM DEPRESSIONS AND STANDARD DEVIATIONS PER DAILY 25 MINUTE EXPERIMENTAL SESSION FOR THE C57 BLACK AND C-SCOTT ALBINO GROUPS

	Means		Standard deviation	
Days	C57	C-Scott	C57	C-Scott
1	77.2	44.0	23.7	14.4
2	58.1	36.7	19.4	16.0
3	45.6	35.2	14.9	13.7
4	41.8	34.5	15.2	12.5
5	38.8	37.9	14.4	15.2
6	39.6	30.9	21.0	16.9

Statistical comparison of the variability of the two groups shows that the C57 Black group is significantly more variable than the C-Scott Albino group on Day 1 only ($F23, 23 = 2.73$, $P = .01$). The groups do not differ significantly with respect to the variability in frequency of platform depressions on subsequent days. Examination of the standard deviations listed in Table 1 reveals no consistent trend in these data for either group.

Analyses of mean numbers of platform depressions in successive five-minute intervals within test sessions showed slight, statistically insignificant tendencies toward reduced rates for both groups in latter portions of the test sessions.

Analysis of the records of the mean time spent on the platform showed no consistent differences between the two groups nor any consistent changes over the six test days. It is noteworthy, however, that the six-day over-all mean time spent on the platform was 597 sec. for the C57 Black group and 618 sec. for the C-Scott Albino group. This is 40 and 41 per cent, respectively, of the time in the 25 min. test period. It would be expected that if the animals spent equal amounts of time in all parts of the box, they would have spent 13 per cent of the time on the platform when the area of the box is used as the base line, or 25 per cent when the circumference of the box is so used. Assuming 25 per cent as the probable maximum estimate, we would expect the time values to be close to 375 sec. To determine whether the obtained time values could have come from a population with a true mean of 375 sec., a *t* test was performed (2, p. 99) comparing the six-day over-all mean time (607 sec.) with the estimated time of 375 sec. Since there were no significant differences between the daily mean time values for the two groups, these values for both groups were pooled for each of the six experimental days and the six values so obtained were considered to be independent estimates of the true six-day over-all mean value. This test showed that the obtained values differed significantly from the expected ($t = 11$, df $= 5$, $P = < .001$).

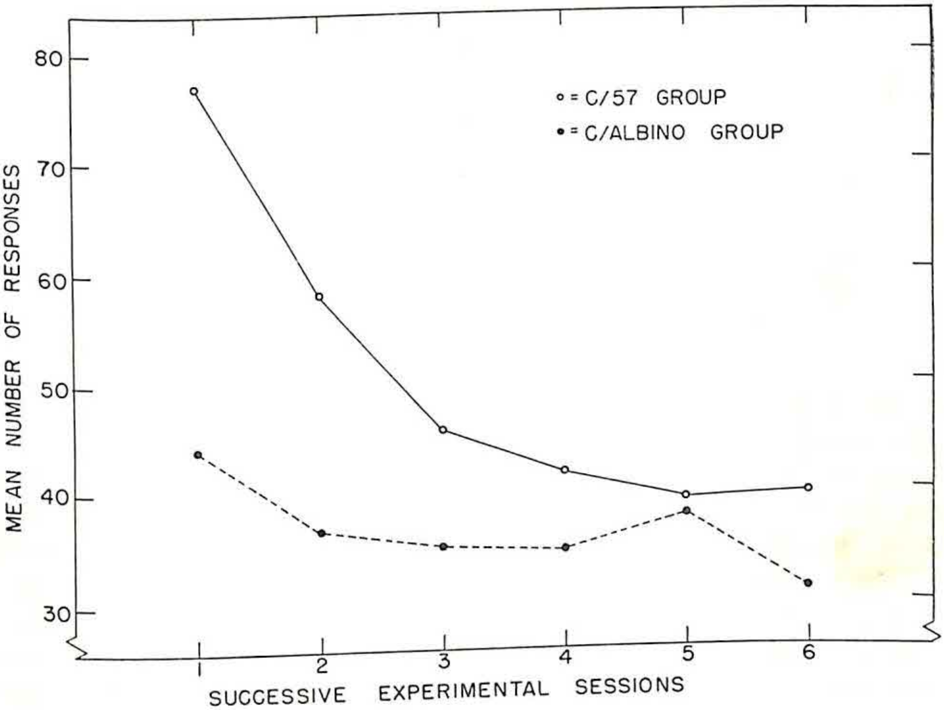

FIGURE 1
THE MEAN NUMBER OF PLATFORM DEPRESSIONS FOR EACH GROUP AS A FUNCTION OF SUCCESSIVE 25 MIN. EXPERIMENTAL SESSIONS

F. DISCUSSION

The data clearly demonstrate the effect of the genetic variable on the frequency of emission of a class of unconditioned operant responses. The strain difference appears to have its strongest effect upon the rate of decay of the function relating platform depressions to successive exposures to the test situation (Figure 1). The C57 Black group curve starts higher and decays at a greater rate than the C-Scott Albino curve. The fact that the two groups do not differ significantly in terms of mean numbers of platform depressions after the first three test days, however, prevents drawing the conclusion that the strains differ in over-all general activity levels, assuming that frequency of platform depressions provided a valid indication of such activity levels. It seems reasonable to expect that if the two strains did differ in over-all general activity levels, then the difference would have been manifested on each of the six test days to about the same extent. This, obviously, did not occur.

The finding that the *S*s of both groups spent a considerably greater proportion of test session time upon the recording platform than would be expected under the most liberal estimate indicates that the recording platform was not providing an unbiased sample of general activity in the test cage. Evidently, the characteristics of the recording platform were leading to a concentration of activity in the vicinity of the platform. For this reason and for the reason that the strains differed only initially in terms of mean frequencies of platform depressions, the conclusion that the unconditioned level of the class of operants measured in the present study was a valid indicator of general activity level is not warranted. Although the curves obtained in the present experiment resemble the operant level curves for bar-pressing behavior in the rat, the resemblance cannot be interpreted as showing the suggested relationship between unconditioned level of operant behavior and general activity (6). The study of this relationship requires another mode of experimentation.

To account for the concentration of activity in the vicinity of the recording platform, the differences between the recording platform and the dummy platforms were studied. Since the platforms were designed to be visually as similar as possible to each other, and since the *S*s were run in virtual total darkness, visual differences would not appear to be the important factors. One obvious difference between the dummy and recording platforms was the auditory stimulation produced when the recording platform was depressed. Since no effort was made to control the auditory consequences of platform depression, each depression was closely followed by an audible "click" of the microswitch and noises produced when the relays and recording equipment were activated. Another difference between the recording platform and the dummy platforms was the slight movement of the recording platform when the mouse moved on and off. Still another difference was the fact that when the recording platform was depressed, the slots in the sides of the box at the floor through which the shafts supporting the platform entered, became accessible to the mice. With the platform depressed, slits about ⅝ in. long and ⅛ in. high were revealed. Similar slits were not present in the regions of the dummy platforms.

Apparently, this stimulation, coming as a direct result of a response to the platform, was acting in a reinforcing manner and strengthening the behavior directed toward the region of the recording platform. At the time the experiment was planned, there appeared to be no *a priori* reason for considering this class of stimuli, which have usually been considered neutral, as reinforcing. The results of the present experiment indicate, however, that the sensory consequences of a particular behavioral act may, under the proper conditions, reinforce that behavioral act. Other work carried out since the time when the present work was done has confirmed this hypothesis. Girdner (3) has demonstrated that the rate of bar touching by the white rat is increased by presenting a dim light or a buzzer as a consequence of the response. Kish (4), using mice as subjects, has demonstrated that a bar contact response is learned when the onset of dim illumination is presented as a consequence of the response.

Girdner (3) has attempted an analysis of his results in terms of the concept of novelty of stimulation. It is thought that novelty of stimulation operates in conjunction with an exploratory or curiosity motive in such a fashion that behavior which produces this stimulation is strengthened. The important conception, for this analysis, is that the strength of operant behavior, as measured by response rate, will be a direct function of the degree of novelty of the stimulation. One factor affecting this novelty would be the amount of previous exposure to that stimulus.

This analysis can be applied to both the present results and to the results of the operant level study by Schoenfeld *et al.* (6). The situation in which the bar-pressing operant level data were gathered is in some respects similar to that of the present study. In the Columbia version of the Skinner box, each bar response of the *S* is followed by a microswitch click, recorder noises, and movement produced stimulation. In addition, the bar is introduced into the Skinner box through a prominent *H*-shaped slot in one side. Much of the unconditioned bar pressing activity in the Skinner box may be reinforced by the novel stimulation arising as a consequence of bar pressing. No doubt, too, some bar presses are produced when the subject within the box "noses" the opening through which the bar enters. Such "nosing" behavior is commonly observed in rodents. The extinction-like function appearing as a result of successive exposures to the experimental situation might conceivably result from a gradual diminution of the novelty and consequent reinforcing power of these stimuli.

The same general analysis may be applied to the results of the present experiment. The drop in platform depression rate as a function of days may be considered as the result of decreased novelty of the stimulation produced by platform depression. In this context, the differences which were found between the two strains of mice may be interpreted as differences in initial degree of reactivity to the stimulation occurring with platform depression. Stated in another way, the C57 Black mice in the present test situation were genetically more highly predisposed than the C-Scott Albino mice to be reinforced by the changes in the environment which occurred when the recording platform was depressed.

G. Summary

An experiment was carried out to obtain information concerning the relationship between the unconditioned level of operant behavior and activity, and the effect of genetic differences on this relationship. Two groups of 24 adult male mice each of the C57 Black Subline 6 and of the C-Scott Albino strains were used. A test cage was designed to provide a sample of operant behavior represented in general activity in a manner analogous to that followed in determining the unconditioned level of bar-pressing behavior in the rat. The mice were tested in total darkness for 25 min. each day for six consecutive days, the frequency of depressions of a platform located in the test cage and time spent on this platform being recorded. The results led to the following conclusions:

1. For both strains, the mean number of platform depressions decreased with successive days, asymptotes being reached within the six days involved in the experiment.

2. The mean number of platform depressions emitted by the C57 Black group was significantly greater than that emitted by the C-Scott Albino group for the first three days. The two strains did not differ significantly thereafter.

3. Both strains spent a significantly greater amount of time on the platform than would be expected if the platform were giving an unbiased sample of activity in the test cage.

4. The conclusion was reached that frequency of platform depressions within the test cage could not be accepted as a valid indicator of general activity.

5. The hypothesis that stimulation arising from platform depression was reinforcing the behavior directed toward the platform was found adequate to account for the results of the experiment.

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REVIEWED BY MURRAY H. SHERMAN

Not very many years ago one heard that a major advantage of the Rorschach test was that it could be adapted to *any* system of psychology (5). Recently the naïvete of this point of view has become apparent (6) and there have been several attempts to integrate Rorschach psychology within a more general theory of personality development (1, 2, 6, 11, 13). The prominence and clinical applicability of psychoanalysis has made it inevitable that certain of its concepts should be considered in Rorschach interpretation. Rorschach (9) himself made use of some analytic concepts, but after his death the test was used almost as if it posited its own personality theory (11).

Several years ago attempts were made by Bühler (2) and by Beck (1) to explain certain aspects of Rorschach productivity in psychoanalytic terms. It was, however, apparent that psychoanalytic theory was grasped in only its most superficial aspects, and the relationships postulated were based upon similarities of terminology which happened by chance to exist in both Rorschach and analytic language. For example, on the basis of dubious statistics Bühler (2) states that FK (use of shading for vista or three dimensional responses) is related to "self-awareness, self-consciousness and apprehension." Since superego in pychoanalytic terms also implies self-awareness, Bühler says that "the best approximation to superego characteristics is the sign FK (2, p. 31)." There is a complete omission of any rationale formulation which could link vista perception to ordinary psychological processes, which in turn could be explained with analytic concepts. Such formulations as these have made it apparent that Rorschach writers needed first to understand psychoanalysis before Rorschach findings could be given additional meaning in analytic terms.

In *Psychoanalytic Interpretation in Rorschach Testing* we find a happy combination of both psychoanalytic and Rorschach teaching. In simple and direct language Schafer has made clear many psychoanalytic formulations such as the concepts of defence, of regression in service of the ego, and of adaptation. His description and explanation of these concepts are frequently more lucid than the psychoanalytic source material itself. Having elucidated some basic formulations of psychoanalysis Schafer then goes on to explore many different dimensions of the Rorschach in order to lend increased significance to test findings.

Schafer deals first with the dynamics of the testing situation. The rôle of the tester is seen as "voyeuristic, autocratic, oracular and saintly." Each of these attitudes influences the psychologist-patient relationship to some extent, but in exaggerated forms they can seriously distort test results and interpretations. It is also important to evaluate the patient's own attitudes towards his test responses. Does he see his responses as exterior objects or as extensions of himself? Is he cruel or kind toward his test products? Is he proud or disparaging? Each of these attitudes has dynamic significance and in exaggerated forms can point to particular psychopathology.

The response process itself is viewed as taking place on many different levels of psychic functioning. Certain test contents have deeply symbolic significances which are akin to dream contents. Other responses appear more like ordinary daydreaming and still others seem to lie quite close to basic perceptual processes. This entire continuum can be viewed in terms of the extent to which the subject can tolerate psychic regression and utilize this regression in service of the ego. Certain creative subjects give many deeply symbolic responses which, when balanced by good reality awareness, indicate an ability to make effective use of id resources. Some schizophrenic patients appear overwhelmed by id contents and lack the ego adaptability necessary to reality adjustment.

In the area of content analysis Schafer recognizes the many pitfalls which exist. He is particularly critical of the "dreambook" kind of one to one interpretation of content as proposed by Lindner (8) and by Phillips and Smith (13). Instead of translating a particular content directly into psychoanalytic terms, it is necessary to abstract the implicit *theme* of the content and then to look for confirmatory evidence in other aspects of the test as well as in other content.

Although this approach of thematic analysis may represent an advance over Lindner's more direct interpretation, it is doubtful whether it is a solution to the basic problems of content analysis. The major problem in the area of content is that of precisely why and how *any* particular content (Popular as well as Original) evolves or why it does not evolve. For example, why is it that one subject can translate his oral dependence into a test response of a baby bird with its mouth open for food, whereas another subject with similar oral dependence sees a woman with prominent breasts? In addition, many subjects with oral dependence do not give any oral responses at all on the Rorschach.

It is frequently assumed that a person who sees oral content has more conflict regarding orality than someone who does not. However, it may be that the perceiver of orality deals with his oral needs differently but not necessarily less adequately than the non-perceiver. All of us have oral dependence, but the problem of content interpretation is that of how this dependence comes to be symbolized on the Rorschach in different ways or is not symbolized at all. Precisely what functions are served by the perception of oral content or of any Popular content on the Rorschach? These are fundamental questions which have been taken for granted in Rorschach literature but they deserve extensive consideration and experiment.

In what seems to the writer to be the best chapter in the book Schafer discusses criteria of adequacy in Rorschach interpretation. Many prevalent abuses of Rorschach material, such as genetic constructions and the assumption of "mother" and "father" cards, are keenly criticized in terms of the unwarranted assumptions made. Schafer points out that any given interpretation can have meaning from the points of view of instinct, structural hierarchy, quantitative strength, and adaptation versus pathology. This complexity of the interpretation process points up the gross oversimplification of many psychological reports and statistical studies which interpret particular score patterns in terms of fixed meanings such as "emotional lability" or "immaturity." Rorschach interpretation should be based upon converging lines of evidence, all of which are given direct or indirect expression in actual test responses or behavior.

Schafer then comes to the definition and interpretation of ego defences and their manifestation in the Rorschach. He discusses criteria for the adequacy of defence and the distinction between defence and adaptation. The adequacy of a particular defence depends partly upon the individual's ego identity (3) and partly upon his reality awareness. Reality awareness itself in terms of its deeper implications is not discussed, and this is seen to be a major defect not so much of this book as of the entire field of ego psychology and ego supportive psychotherapy. Reality is almost assumed to be constant objective datum and is thus dismissed from further consideration.

The adequacy of a defence is said also to depend upon its ability to withstand invasion of id forces. At the same time it is recognized that id forces can arise and then be sublimated into creative forces. Schafer recognizes that the entire problem of sublimation is a confused one, but in his discussion of adaptation on the Rorschach he fails to differentiate what may be sublimation in creative people from what is invasion of the ego by the id in schizophrenia. As a result his entire discussion of adaptation is relatively ambiguous.

The defences discussed in this book are those of repression, denial, projection, and the obsessive-compulsive operations (regression, isolation, reaction formation, and undoing). Each of these defences is illustrated with four Rorschach protocols which run the gamut from approximate normality to psychotic disorganization. In general, Schafer is entirely adequate and informative in his description and discussion of these defences. At times, however, he is quite limited in his diagnostic formulations. For example, the defence of denial is discussed almost entirely in terms of Lewin's (7) formulation concerning the uses of denial in hypomania. Schafer overlooks the fact that denial is also particularly characteristic of hysterical reactions and he bases all four case discussions upon denial in hypomania or "pollyannaism."

In general it can be stated that Schafer's book is by far the best integration of Rorschach psychology and psychoanalysis yet to appear. It will doubtless be vastly influential for a long time to come. However, there are several basic defects to Schafer's approach. First of all, the Rorschach material itself seems relatively atypical of protocols that are commonly obtained in ordinary public institutions. The records are those of intelligent, comparatively willing and productive patients. These patients give more responses and more symbolic content than do most patients of lower socioeconomic status (10, p. 229; 12). For example, the four hysterical repressive patients whose protocols are quoted, average 13 years of education and have a mean *IQ* of 113. They give an average of 26 responses with considerable additional verbalization, whereas the more typical hysteric is likely to give considerably fewer responses with relatively meagre verbalization (4). The extent to which Schafer's case material and general frame of reference can be generalized is thus open to question.

A more basic criticism concerns the methodology used in the integration of psychoanalytic concepts with Rorschach material. Schafer goes always *from* psychoanalysis *to* the Rorschach. An alternate procedure would be to start with basic Rorschach data and rationale and then to integrate this material with psychoanalytic concepts. Schafer's procedure seems to be relatively arbitrary superimposition of psychoanalytic theory upon the Rorschach. A result of this sequence is that much is taught about psychoanalysis but relatively little is learned about the Rorschach. One finds that any ego defence may be reflected in any aspect of the Rorschach. For example, men who defend against passive needs are said to give few Rorschach responses or many Rorschach responses or to do any of a number of other things. This is entirely accurate, but from the point of view of understanding the Rorschach it would be more helpful to investigate the differences between passive men who give few responses and those who give many responses. Moreover, by showing how every aspect of the Rorschach is affected Schafer fails to indicate systematically how any particular aspect is affected. The question of how the defence of projection would affect the way human movement responses are perceived in different diagnostic groups does not come up at all, but instead we learn how projection can be evident in every single aspect of the Rorschach.

In summary, it is felt that this is the first Rorschach book to appear which indicates an adequate grasp of psychoanalytic concepts. It deserves particular commendation as an exposition of psychoanalytic ego psychology and as a critical appraisal of criteria for Rorschach interpretation. The book suffers from some of the ambiguities of ego psychology, from some minor diagnostic confusion, and sampling inadequacy. In particular, Schafer's methodological approach has precluded elucidation of unique Rorschach characteristics by superimposing psychoanalytic concepts upon the total Rorschach situation, instead of proceeding from particular Rorschach data and rationale to psychoanalysis.

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(Manuscripts are printed in the order of final acceptance)

An investigation of light avoidance as motivation in a perceptual differentiation problem in the cat 143
By Willard E. Caldwell and Donald R. Hoffeld

The application of light avoidance in a perceptual differentiation problem in the Pekin duck 153
By Willard E. Caldwell and Roderick H. Boes

An investigation of geotropism utilized as motivation in the maze performance of golden hamsters 161
By Willard E. Caldwell and William C. Stebbens

Item order and difficulty in four verbal subtests of the Bellevue-Wechsler Scale 167
By Grace Rubin-Rabson

(OVER)

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A comparison of the interests of English and American school children . . 175
By Leona E. Tyler

A study of a method of appraising self-acceptance and self-rejection . . 183
By Sarah Scherer Spivack

A test of the magnetic theory of homing in pigeons 203
By Arthur R. Orgel and James C. Smith

The learning of rôles and of concepts as twin processes 211
By Anselm L. Strauss

Some mathematical and logical concepts in children 219
By Betsy Worth Estes

Sexual behavior of C57BL/10 mice and its relation to early social experience 223
By John A. King

Sissiness and tomboyishness in relation to sibling characteristics . . . 231
By Helen L. Koch

Discrimination of visual patterns as a function of motivation and frequency of reinforcement 245
By J. M. Warren and John F. Hall

Response of juvenile delinquents to the Thematic Apperception Test . . 251
By Florene M. Young

Leisure-time adjustment of the aged: II. Activities and interests and some factors influencing choice 264
By Leo Chalfen

BOOKS 277

CRITICAL REVIEWS OF RECENT BOOKS 279

Piaget, J. *The Construction of Reality in the Child.* (Reviewed by Nathan Israeli) 279

BOOKS RECENTLY RECEIVED 289

The Journal of Genetic Psychology, 1956, **88**, 143-151.

AN INVESTIGATION OF LIGHT AVOIDANCE AS MOTIVATION IN A PERCEPTUAL DIFFERENTIATION PROBLEM IN THE CAT*

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A. INTRODUCTION

The problem of utilizing exteroceptive stimulation as motivation in perception problems in animals is an important one. Keller (3) was one of the pioneer investigators utilizing light avoidance in rats. Caldwell and Richmond (2) investigated light avoidance in perceptual differentiation in the pigeon. The pigeons were trained to discriminate between a circle and a triangle, with a very bright light and a dark box utilized as motivation and reward respectively.

B. STATEMENT OF THE PROBLEM

The objective of this paper is essentially the same as that of the experiment performed by Caldwell and Richmond (2) except that this procedure was adapted to the cat and some additional conflict situations were introduced. Stated operationally this problem is as follows: What is the nature of the response latency and correct responses of a group of cats who are placed in a brightly illuminated discrimination box and are allowed to enter a goal box which has very little light?

C. APPARATUS

The apparatus for this experiment consisted of a wooden box which was divided into two compartments. One side was designated as the entrance compartment and the other side as the goal compartment. These two compartments were separated by a black board which contained two geometrical openings, a circle and a triangle, both of which were trimmed in aluminum paint. This board could be removed and reinserted so that the circle and triangle could be reversed. Once the animal entered its appropriate door, a board could be lowered covering the geometrical doors so that the animal

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*Received in the Editorial Office on June 16, 1954.

[1] The authors wish to express their appreciation to Mr. Joseph Abel for his photographic work.

could not reenter the entrance compartment. There was another board which covered up the goal box so that there was relatively little light in the goal box during the reinforcement period. The walls and floor of both the entrance compartment and the goal box were painted with aluminum paint and the board remained on top of the goal box during the entire experimental period except when the animal went into the wrong door.

The apparatus was 3 feet wide, 6 feet long, and 2 feet deep. The entrance and goal compartments were each 3 feet by 3 feet.

In Part I of the experiment one 300-watt light bulb in a cone type of reflector was suspended over the entrance compartment and another over the goal compartment. For the remaining parts of the experiment each compartment contained two reflectors with two 300-watt light bulbs each.

In Figure 1, the top horizontal column of pictures reading from left to right shows first the apparatus as a whole with a cat entering the circle and second shows a cat being placed in the circle when it refused to go in. The third picture shows the cats in the living cage, in which they could climb about. The two remaining horizontal rows show cats from the instant of being placed in the entrance compartment to the stage when they enter the circle. The last picture shows the panel covering both geometrical doors during the period of reinforcement in the dark.

The temperature was measured at intervals and it was found that there was less than a two-degree difference in temperature between the goal compartment and the entrance compartment. The temprature within the experimental box as a whole ranged from 70° to 90° F.

D. Subjects

Eight cats were utilized for this experiment. There were two litters, the first being 5 months old and the second 3½ months old. There were five females and three males. The cats were kept in a cage (see Figure 1). They were fed at times other than the experimental period and an attempt was made to keep them relatively sated before the experiment took place. They were allowed to run around the laboratory in the morning. They could also climb about on the sides of their cage.

E. Procedure

This experiment was divided up into five parts. In Part I of the experiment each animal was placed in the entrance compartment, and its first choice, whether a circle or a triangle, was to be its correct one for the remainder of the experiment. This first trial was rather critical because it was desired to have the correct geometrical choices evenly distributed among the eight animals so that the results could not be attributed to some sort of geometrical preference. Four of the cats entered the circle and three entered the triangle. The remaining cat was placed in the triangle at the end of the time limit so that there was a total of four animals for each geometrical door. The animals were run once every afternoon for 24 trials. When an animal was placed in the entrance box it was allowed a five-minute period to make its correct choice. If the animal entered before the five minutes

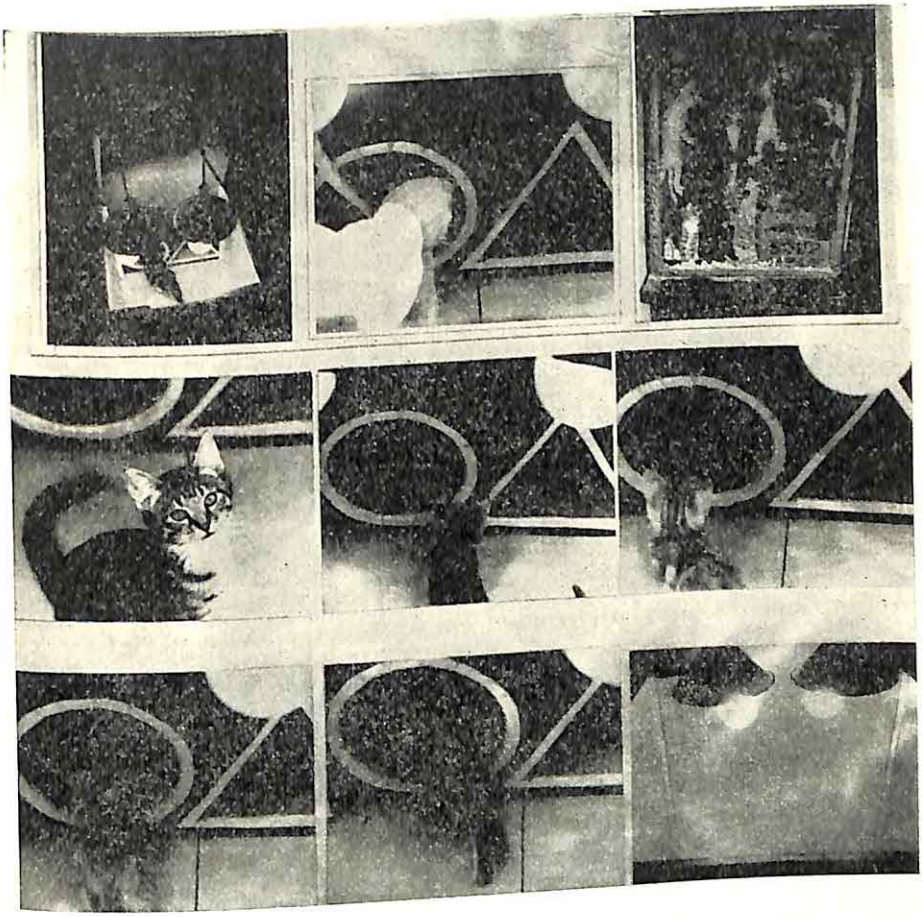

FIGURE 1

The top horizontal row illustrates first the apparatus as a whole, second an animal being forced through the circle, and third the living cage. The second and third horizontal rows trace cats through various stages in entering the dark goal box.

was up, a slide was lowered, shutting out the light from the two geometrical doors, and the time recorded. The animal was then allowed to remain in the goal box for five minutes. At the end of five minutes the animal was removed and placed in its cage. If an animal went into the wrong geometrical door, the top of the goal box was removed and light was allowed to enter the goal box. This was usually enough to make the animal go back into the entrance compartment, but, if it did not go back, the experimenter shoved it gently into the entrance compartment through the door it had entered. Every entrance into the wrong compartment was scored as an error. If the animal had not made the correct choice by the end of five minutes, the experimenter shoved it gently through its proper door and pulled down the slide. The animal was left in the goal box for five minutes.

It is important in this type of experiment to try to avoid position habits. The circle and triangle were varied from side to side in a random fashion. Each would be located on the left side in the following order: triangle, triangle, circle, circle, circle, triangle, circle, circle, triangle, triangle, etc.

In Part II of the experiment, the animals were run for a total of 16 days, five trials per day. The time limit was two minutes in the entrance box and one minute in the goal box. The trials operated so that after the first animal completed his first trial the other seven were run in succession before the first animal was run on his second trial of the day. This allowed approximately 25 minutes between each trial. The procedure for recording errors, response latency, and correct choices was the same as for Part I of the experiment.

In Part III of the experiment the procedure was the same as Part II with the exception that the animals were only run for 29 trials and the top was removed from the goal box so that the intensity of light was the same in the goal box as it was in the entrance box.

In Part IV of the experiment the animals were subjected to 20 trials where the correct doors were switched in a random fashion. If an animal had been rewarded for going in the circle, it was now rewarded for going in the triangle some of the time and vice versa.

In Part V of the experiment Animals 4 and 8 were subjected to the following intense training routine. They were given 15 trials where the correct doors were switched as in Part IV. Each animal ran one trial, waited while the other animal ran one trial, then ran another trial, etc. Next they were given five trials in a row where, whichever door they selected, the top of the goal box was removed and they were forced to return to the entrance box. This whole procedure was then repeated, 15 trials of varying correct responses and five trials of no correct response. The trials were all run on the same day.

F. Results

Out of 24 trials in Part I, Animal 1 made 4 correct choices out of a total of 8 responses; No. 2, 2 out of 4; No. 3, 1 out of 2; No. 4, 6 out of 11; No. 5, 12 out of 20; No. 6, 3 out of 8; No. 7, 12 out of 36; and No. 8, 2 out of 8.[2] In this part of the experiment only No. 7 and No. 5 began to show signs of making the discrimination. The response latency in these two animals began to show ascending-descending properties rather than remaining constant.

In Part II of the experiment the animals received 5 trials per day for a total of 80 trials. Out of 80 trials, No. 1 made 17 correct choices out of 29 responses; No. 2, 16 out of 26; No. 3, 2 out of 2; No. 4, 36 out of 69; No. 5, 20 out of 34; No. 6, 32 out of 50; No. 7, 3 out of 6; and No. 8, 32 out of 79.

In Figure 2 are shown for each individual animal the percentages of correct responses per five trials and the percentges of total time (5 × 120 = 600 sec.) utilized per five trials. In this connection it should be kept in mind that the maximum time was 120 seconds in the entrance compartment. The ascending-descending properties of their performances are clearly shown in Animals 1, 2, 4, 5, 6, and 8. The correct responses tended to increase, then decrease, as did the length of time.

In Figure 3 the curves for the same data were constructed for the average total group performance. The percentage of total time equals total time utilized/4,800 seconds. The percentage of correct responses is equal to total correct responses per five trials/40. This again points to the dynamic properties of these discrimination curves.

In Part III of the experiment the animals were run for 27 trials with the goal box having the same intensity of light as the entrance compartment. Animal 1 made 12 correct choices out of 26 responses; No. 2, 1 out of 6; No. 3, 3 out of 9; No. 4, 4 out 9; No. 5, 15 out of 25; No. 6, 17 out of 24; No. 7, 19 out of 25; and No. 8, 18 out of 49.

In Part IV of the experiment the animals were subjected to a conflict situation in which they were randomly rewarded with the correct door, with the incorrect door also being reinforced the rest of the time, including a random blocking of the previous correct door. In Cats 1 through 7 nothing unusual was noted, whereas in Cat 8 some unusual behavior was observed.

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[2] It should be noted that many errors could be made on a single trial while only one correct response per trial is possible. An example of this is Animal 7 who made 13 errors on Trial 13.

Some qualitative observations of Cat 8. The correct choice for Animal 8

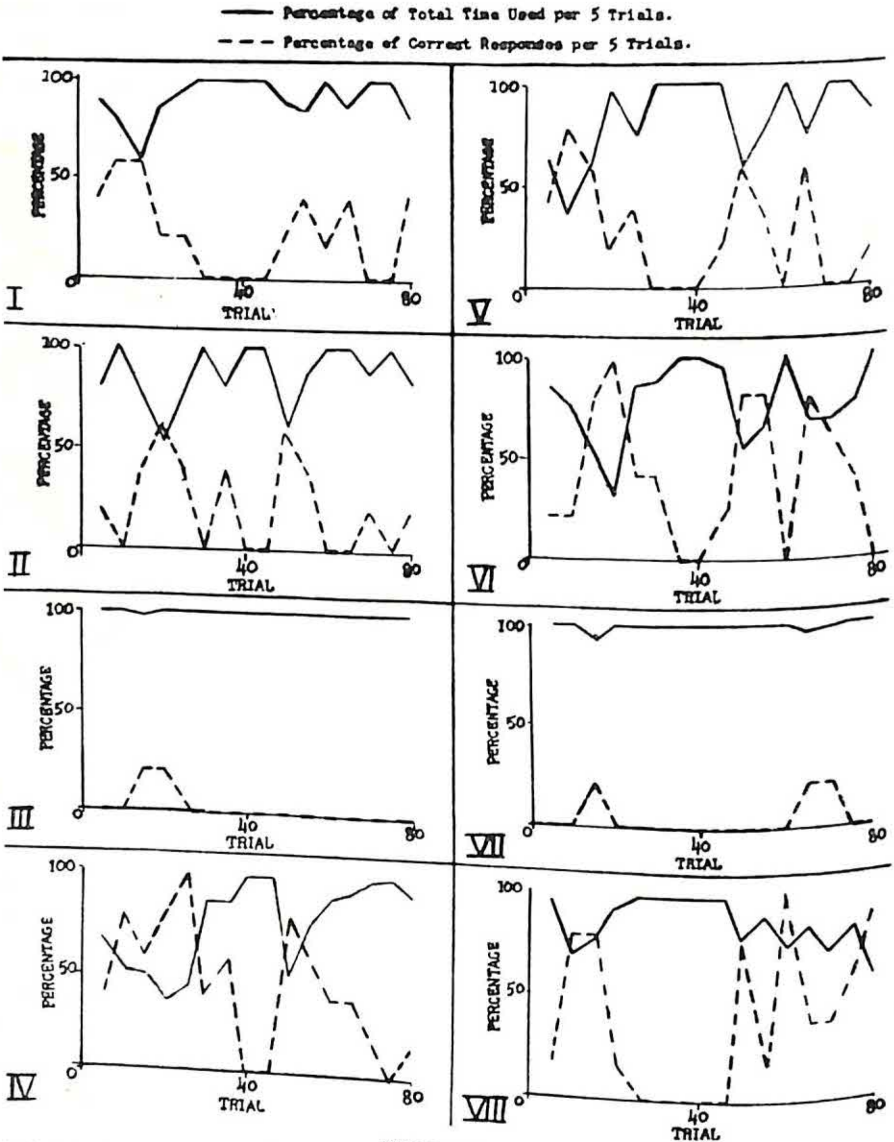

FIGURE 2

Individual curves for each of the eight animals are shown. These show the percentage of correct responses and the percentage of the total time to make these responses for the total of 80 trials of Part II. The percentages are based on a per five trial basis.

had been a circle. The first two trials the animal was rewarded for entering the circle. The third trial the animal entered the circle door and the top was taken off the goal box and he was forced to return to the entrance compartment. He then began to defecate in the entrance box (no cat had done this during the entire experiment). The animal then entered the triangle door and was rewarded. On Trial 4 the animal again tried to enter the circle and was not reinforced. It then entered the triangle and was reinforced. At Trial 5 the animal became practically immobile and was placed in a small wire cage by itself, where the following qualitative observations were made.

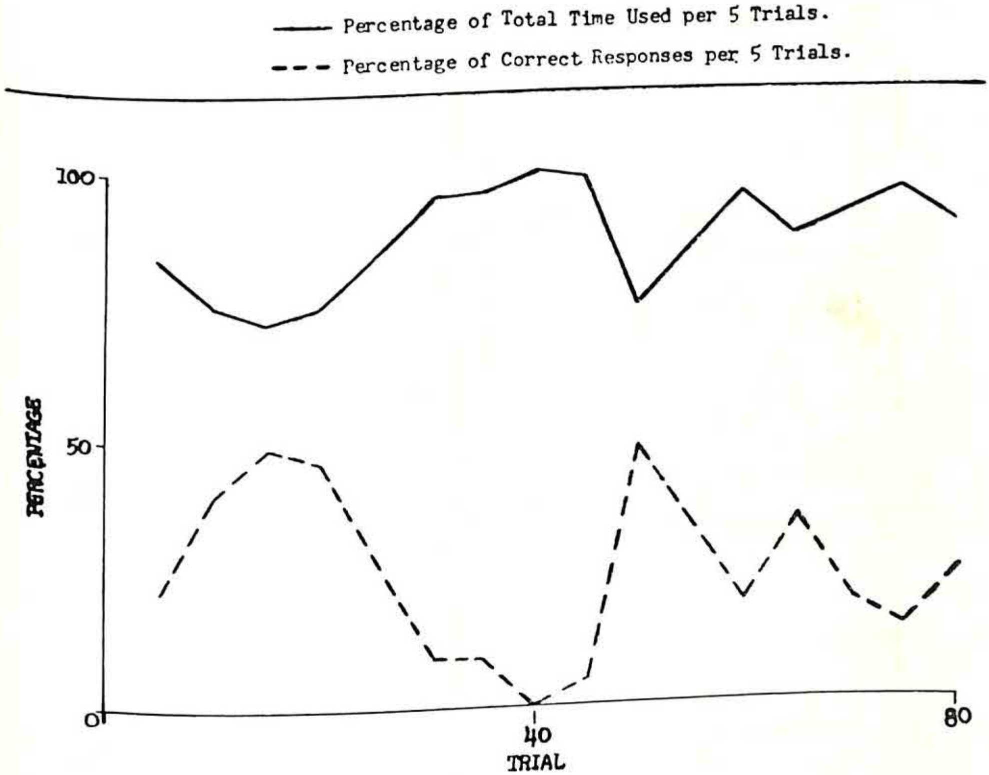

FIGURE 3
This shows the average total percentage of correct responses and the average total percentage of the total time per five trials for the group in Part II of the experiment.

1. While in the cage the animal would stick its head and nose into one of the four corners of the cage. It was extremely rigid and it took consider-

able force for the experimenter to pull its head out of the corner. Once released it would immediately crawl on its side and head for the next corner. Sometimes it would raise its rear and its hair would stand up.

2. When the cat was picked up it was very rigid and seemed to be breathing rapidly. It cried continually and there was much salivation.

3. When it was placed on a flat table it would cry and crawl around on its side in a circular manner.

4. When placed back in the cage the cat would immediately stick its head into a corner.

5. This general manner of behavior lasted from 4:30 in the afternoon until 11:30 that night. By that time the cat was lying on its side with its eyes closed, breathing rapidly. At this time the experimenters turned off the lights and left the laboratory.

6. The next morning the animal's behavior appeared to be normal.

The animal was continued on its regular schedule and no further incidents occurred.

In Part V of the experiment Cats 4 and 8 were subjected to 15 trials of the same routine as Part IV, which was then followed by five trials in which both doors were counted as errors, no reinforcement being given. Animal 8 defecated when this procedure was applied. The animals also exhibited the following behavior:

1. They jumped continually at the sides of the box, sometimes as much as 20 times during a two-minute period.

2. They would pick out one door and continually enter it, sometimes as often as 15 or 20 times during a two-minute period.

G. Discussion of Results

This design was essentially a qualitative exploratory one, and the qualitative aspects are possibly the more suggestive. The curves here do not reflect the general properties often present with the primary drives. Rather they show an ascending-descending characteristic. These findings are essentially similar to those reported by Caldwell and Richmond (2) where pigeons were utilized in a similar design. Butler (1) reports response latencies to visual exploration incentives and the curves reported resemble these.

In Part III of the experiment where the goal box was illuminated, it may be noted that some of the animals improved in their performances. This is an interesting point, because in a great many of these light aversion experiments the dark goal box may be disturbing relative to the animal, and the reward may not be just the dark goal but the lesser intensity of the living quarters, which might not be as severe a reduction in stimulation.

Parts IV and V, which are the conflict parts of this experiment, suggest the further utilization of this type of technique in investigating animals' reactions to stress. In observing Animal 8 and its tendency to stick its head in the corner, it suggests the hypothesis that the animal had a breakdown in its discrimination to light in general, that is, a breakdown in discrimination analogous to some of the other experiments where the animal could not discriminate between tones.

H. SUMMARY AND CONCLUSIONS

Eight cats were trained to discriminate between circles and triangles where an intense light was utilized as motivation and a reduction in light as reward. The animals were also subject to conflict situations where the geometrical patterns were alternated in respect to the ones being rewarded with less light.

The following conclusions are suggested from this experiment:

1. Both the correct responses and the length of time it took to make the correct choice varied in an ascending-descending fashion, i.e., the animals would get better in their performance, then worse, etc.
2. Cat 8, when subjected to a conflict situation by changing the correct door randomly, developed a seizure-like state which lasted for at least seven hours. This condition was characterized by rigidity, salivation, and an inability to walk in an upright position. These observations suggest that exteroceptive motivation might merit further exploration in the study of abnormal behavior in animals.
3. There were wide individual differences in the ability of these animals to discriminate the geometrical designs under the stated conditions.

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THE APPLICATION OF LIGHT AVOIDANCE IN A PERCEPTUAL DIFFERENTIATION PROBLEM IN THE PEKIN DUCK*

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A. INTRODUCTION

The problem of utilizing different forms of exteroceptive stimulation as motivation in perception and learning problems is becoming increasingly important. In a previous experiment (2) light avoidance was used with pigeons. The animals had to discriminate between a circle and a triangle; when the animals made the correct discrimination they were reinforced by a considerable reduction of light.

Another increasingly important problem in comparative psychology is the experimental investigation of animals other than the white rat and monkey. Other animals may involve special difficulties and it is up to the comparative psychologist to integrate them into a laboratory setting.

The general objective of this study is to investigate further the problem of exteroceptive motivation in perception problems and to explore the possibilities of utilizing another animal, the pekin duck.

B. STATEMENT OF PROBLEM

The problem stated operationally is as follows: What is the nature of curves representing time for correct choices, and the number of correct choices for a group of pekin ducks who are presented with a discrimination problem involving a circle, and a triangle, where the motivation is an intensely lighted field and the reward a relatively dark field?

C. SUBJECTS

The subjects for this experiment were seven pekin ducks (female) who were 6½ months old. The animals were kept in an enclosed area of the laboratory (see Figure 1) where they were given an ample account of food and water apart from the experimental situation. They were fed on greens

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[1] The authors wish to express their appreciation to Mr. Joseph Abel for his photographic work, and to Miss Phyllis Blocher for editorial assistance.

and bread. The ducks looked so much alike that they were colored with food dye in order that the experimenter could distinguish them.

D. APPARATUS

The apparatus for this experiment consisted of a large box which was divided into two equal compartments. The entire inside of the apparatus was covered with aluminum paint. The two sections were divided by a panel which was also painted with aluminum and there was a circle and a triangle cut in this panel. These two geometrical doors were trimmed with flat black in order to emphasize their geometrical properties. The box was 6 feet long and 3 feet high and each section was 3 feet by 3. In Part I of the experiment a 300-watt light bulb was suspended about two inches overhead the entrance compartment and one over the goal box. In the remaining parts of the experiment there were two 300-watt light bulbs over the entrance compartment and two over the goal compartment. Each of these lights was suspended in a reflector. The temperature in the entrance compartment and the goal compartment differed by not more than three degrees and averaged 88°. A panel covered the top of the goal compartment. A second panel could be lowered over the geometrical doors when the animal made the correct choice. The apparatus is shown in Figure 1.

E. PROCEDURE

In Part I of the experiment the animal was placed in the entrance compartment. The geometrical door which the animal entered during the first trial was then considered the correct choice for the remainder of the experiment.

The first choice was a rather critical one in the sense that it was hoped that approximately as many animals would pick the circle as the triangle; so as to eliminate the possibility of geometrical preference as the critical variable in the experiment. Animals 1, 3, 5, and 7 went into the circle; Animals 2 and 6 entered the triangle, and Animal 4 did not enter either door. At the end of the 5-minute time limit the animal was pushed through the triangle in order to have approximately as many triangles as circles for correct choices.

The animals were run once every evening for 26 trials. The animal was allowed 5 minutes in the entrance box to make its choice. If the animal made the correct choice before the five minutes was up, the panel was lowered and the animal was allowed to stay in the dark for 5 minutes. If the animal had not made its correct choice by the end of 5 minutes it was gently shoved through its correct door (see Figure 1). The panel was lowered and it was allowed to stay in the goal box for five minutes. If the animal went into the wrong geometrical door the top panel covering of the goal box was lifted so that light was allowed to enter. Usually the animal would then go back

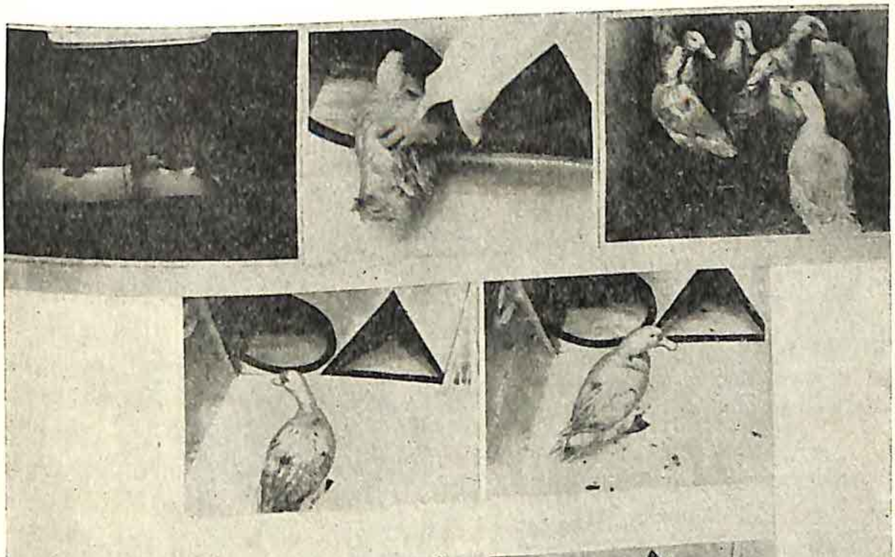

FIGURE 1

In the top horizontal row from left to right is shown the apparatus as a whole, a duck being placed through the circle and the ducks in their living quarters. The left column shows a duck entering the circle. The right column shows a duck entering a triangle.

to the entrance compartment. If however, the animal remained in the compartment after making an error the experimenter would gently shove the animal back through the door which it had entered. It was then allowed to remain in the entrance compartment until the end of the time limit.

In order to avoid the formation of a position habit the doors were shifted from right to left every third trial.

In Part II of the experiment the animals ran a total of 85 trials at 5 trials per day. The time limit in this part was two minutes in the entrance compartment and one minute in the goal box. The trials operated so that after an animal completed a trial the other six animals were run in succession, before the animal was run again.

In Part III of the experiment the animals were run 25 trials, 5 trials per day without the top panel on the goal box.

In Part IV of the experiment the animal was sometimes allowed to remain in the goal box after it had entered through the circle and sometimes after it had entered through the triangle. The order was varied according to a random table.

In Part V, Animals 3 and 6 were presented with 30 straight trials of the same procedure utilized in Part IV.

In Part VI, Animals 3 and 6 were presented with 10 trials in which they were not allowed to stay in the goal box regardless of which door they entered.

F. Results

In Part I out of a total of 26 trials Animal 1 made 9 correct choices out of 13, No. 2 made 3 out of 11, No. 3 made 1 out of 3, No. 4 made 1 out of 5, No. 5 made 9 out of 13, No. 6 made 13 out of 55, and No. 7 made 6 out of 7.

In Part II out of a total of 85 trials Animal 1 made 59 out of 83 correct choices, No. 2 made 0 out of 1, No. 3 made 27 out of 35, No. 4 made 0 out of 0, No. 5 made 33 out of 47, No. 6 made 56 out of 88, No. 7 made 21 out of 29. The curves in Figure 2 show the variations in the number of correct responses made for 5-trial intervals and their relationship to the average time required to make these responses. The ordinate values are percentages of maximum correct responses possible and percentages of allotted time that was required to make the responses.

Excluding Ducks 2 and 4, which made no correct choices, it should be noted that the response latency varies in an ascending-descending fashion, while the percentage of correct response tends to vary conversely in essentially the same manner.

In Part III with the light intensity equal in both compartments, Animal 1 made 9 correct choices, No. 2 made 9, No. 3 made 22, No. 4 made 0, No. 5 made 15, No. 6 made 16, and No. 7 made 2.

Parts IV through VI of the experiment were conducted in order to make some qualitative observations of stress reactions which are discussed below.

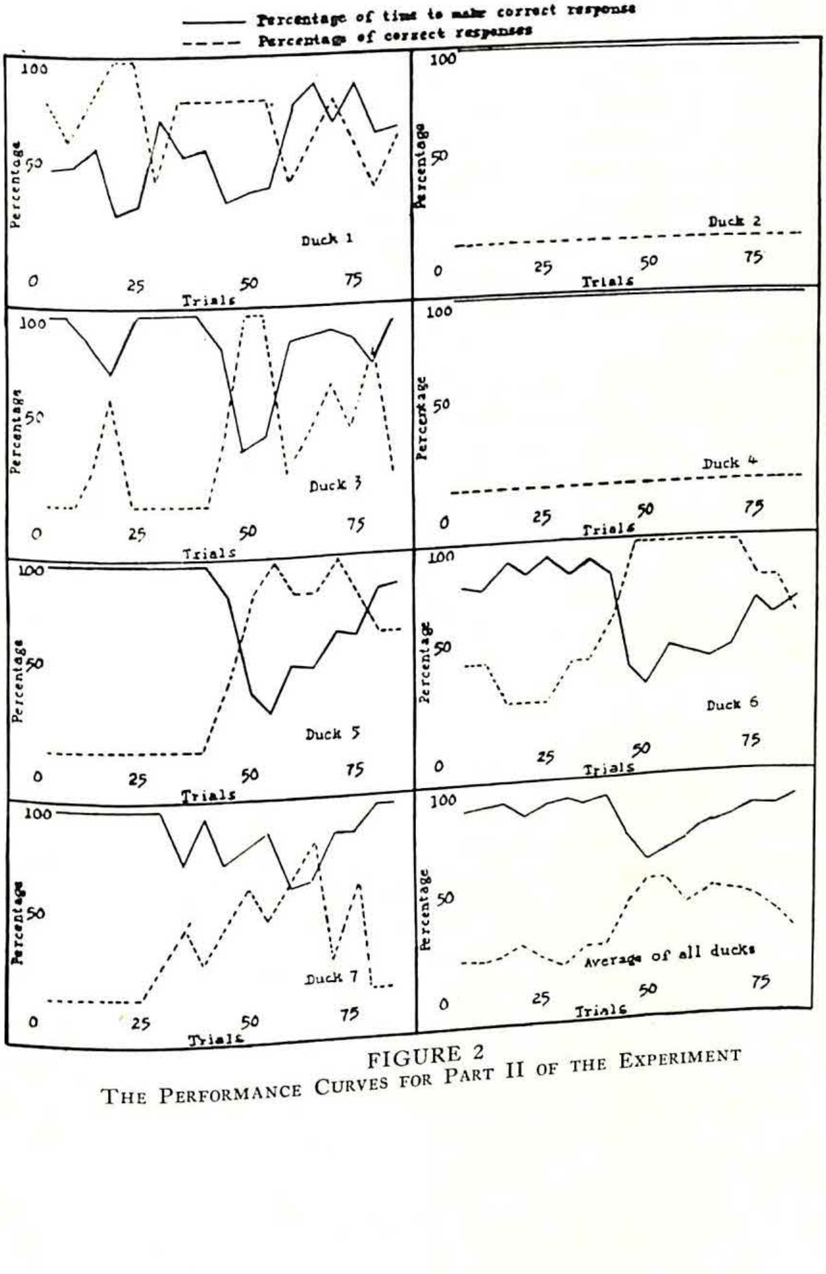

FIGURE 2
THE PERFORMANCE CURVES FOR PART II OF THE EXPERIMENT

G. DISCUSSION OF RESULTS

The ascending-descending characteristics of the response latency curves, and the curves of correct responses are in keeping with those reported by Caldwell and Richmond (2). They are also similar to those reported by Butler (1) who utilized Rhesus monkeys and employed visual exploration as an incentive.

The individual differences in the performance of the ducks was striking. This is exemplified by the difference of Ducks 1 and 4 in Part II of the experiment.

An explanation for the number of correct responses made in Part III, where no rewarding situation was immediately apparent might be due to the rewarding aspect of returning the animals to their less brightly lighted living quarters.

1. *Some Qualitative Observations*

One of the interesting observations made were some of the individual patterns of stress and behavior which these animals exhibited in the apparatus. Figure 3 shows some of the kinds of reactions that were noted. The left column from top to bottom, shows a duck attempting to fly out of the box, a duck ruffling its feathers, and shaking its head and beak, and also a duck twisting its neck. In the right column, from top to bottom the first and second pictures show typical reactions when placed in the box. The third one shows the duck with its neck feathers raised orienting away from the geometrical figures. The ducks would show various tremor-like reactions when placed in the entrance compartment and frequently defecated before entering the goal box. The stress reactions occurred throughout all parts of this experiment. In Parts V and VI some new reactions appeared. The two animals studied tended to keep their beaks open while continually exhibiting a chewing-like reaction.

These observations suggest that this type of animal and design might be further explored as a technique of studying the reactions of stress and conflict.

H. SUMMARY AND CONCLUSIONS

Seven sated pekin ducks were presented with a discrimination problem involving circles and triangles. The motivation employed was an intense light and the reward was a dark goal box. The animals were also subjected to conflict situations involving the circle and triangle.

The following conclusions are suggested from this experiment:

1. There were marked individual differences in the ducks with respect to their ability to make correct choices.

2. Both response latency and percentage of correct responses tended to vary in an ascending-descending manner.

3. Qualitative patterns were present in these animals such as tremor-like reactions, and excessive defecation, etc.

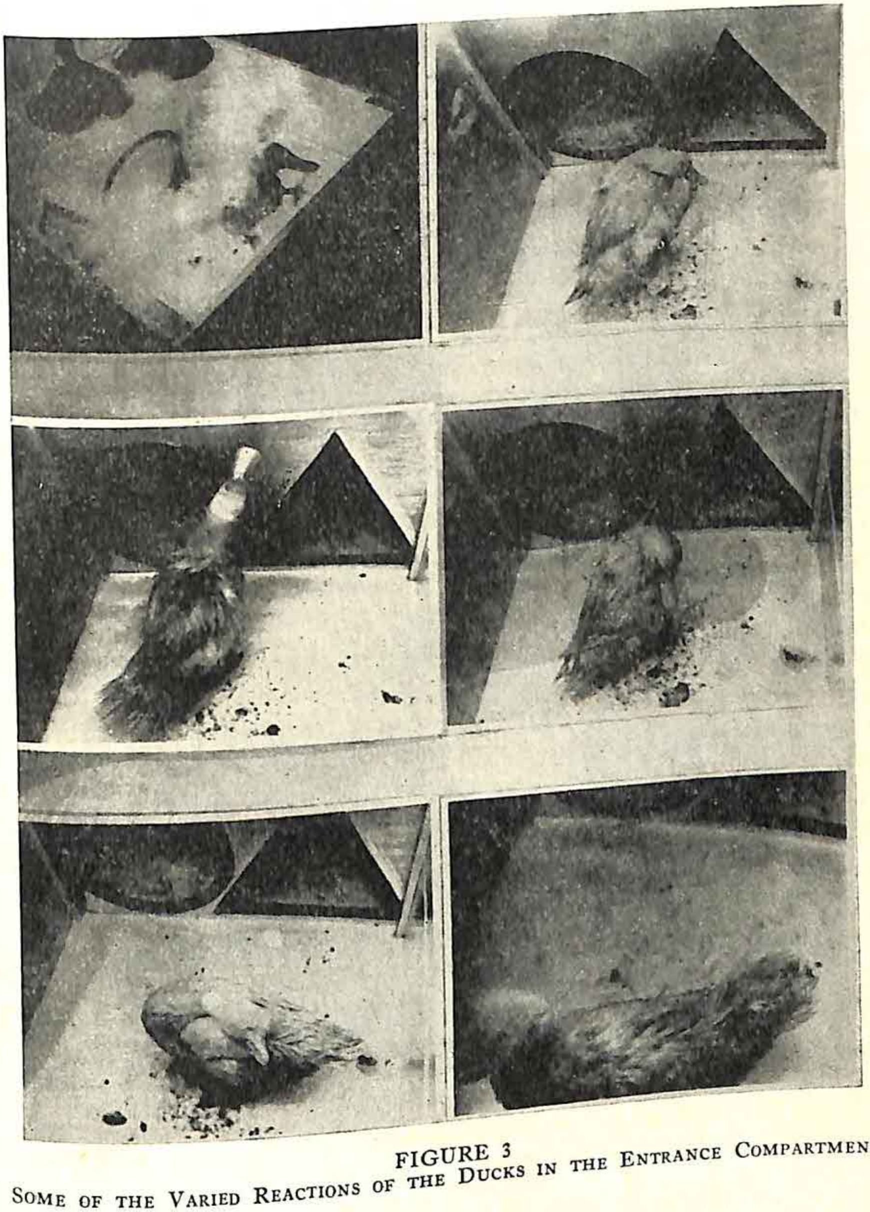

FIGURE 3

Some of the Varied Reactions of the Ducks in the Entrance Compartment

4. When the conflict situation was introduced, new behavioral patterns emerged.

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AN INVESTIGATION OF GEOTROPISM UTILIZED AS MOTIVATION IN THE MAZE PEFORMANCE OF GOLDEN HAMSTERS*

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A. INTRODUCTION

The purpose of this problem was twofold: first, to establish the nature of learning curves in a maze situation where geotropism was utilized as motivation, and secondly, to adapt this procedure to the hamster.

Some of the important early work on geotropism in albino rats was performed by Crozier and Pincus (3), where they reported their observations on the behavior of rats on inclined planes. Pincus (7) studied the rate of creeping as a function of the gravitational stimulus. Upton and Stavsky (8) found that adult rats would elicit negative responses to gravity by means of special training. Hunter (5, 6) attempted to repeat the work of Crozier and Pincus, but found that their results were not uniform. Hovey (4) found that his animals showed improvement with practice. Rejecting a geotropistic interpretation of his findings, he suggested that they could be interpreted in terms of conditioning. Caldwell and Richmond (1) subjected 20 hamsters to a maze where the experimental group ran the maze with an angle of inclination of 21 degrees. The angle began with the entrance compartment, and the animals would have to climb the maze. At the goal box the angle of inclination was zero. The control group ran the same maze with a zero angle of inclination. The error curves reported by Caldwell and Richmond showed the character of first increasing and then decreasing. This curve was similar to one reported by Caldwell and Womack (2) where light avoidance was utilized as reinforcement.

The objective of the present study is to investigate the effect of reversing the angle of inclination on the time and error curves. The animals would have to descend the maze in order to arrive at the goal box with an angle of zero degrees.

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B. APPARATUS AND PROCEDURE

1. *Subjects*

Twenty-four female golden hamsters, purchased commercially and from two to four weeks old at the start of the experiment, were *S*s. Twelve of these were used in the control group and 12 were used in the experimental group.

2. *Apparatus*

For the maze utilized in this experiment see Figure 1. H was made of ¼″ mesh wire attached to a sheet of plywood 43″ by 18.5″. The top of the maze was covered by ¼″ mesh wire. The maze could be raised to a 21-degree angle for the experimental group or lowered parallel to the table for the control group. The goal box would remain parallel to the table for both the experimental and the control groups. The entrance compartment was constructed of wire mesh and plywood. It was supported by a metal rod which would allow it to remain parallel to the table. There were a total of 13 blind alleys. The gates closing the entry way and the goal box were made from a square of wire mesh pivoting on a small wire straddling the alley. There were seven slots over each of seven alley intersections in which could be inserted clear plastic slabs to prohibit retracing. The entire maze was painted flat black and was placed on a laboratory table. The apparatus was illuminated by fluorescent lighting. The temperature remained around 70°F. during the 20-day experimental period.

3. *Procedure*

The hamsters were kept in metal cages, the floors of which were covered with sawdust. The sawdust was changed every day. An ample supply of rabbit pellets and water was kept in the cages at all times.

The same experimental procedure was applied to both the experimental and the control group, except that the maze was tilted at an angle of 21 degrees and the angle of inclination was such that the animals would descend the maze.

Each animal was placed in the entrance compartment and the door was swung shut. When the hamster had passed a retrace gate slot, a plastic slab was inserted and this prevented retracing of that section of the maze. When an animal entered a blind alley with two-thirds or more of its body, this was counted as an error. A 10-minute time limit was set for these animals, so that if they failed to reach the goal box within 10 minutes they were removed and time was recorded as 10 minutes. When an animal reached the goal box it was immediately transported back to its cage.

The experiment was run for 20 consecutive days between the hours of 8 and 12 in the evening.

C. Results and Discussion

Significant time differences between variances were found at the 1 per cent level for Trial 17 and at the 5 per cent level there were no significant differences. For trials with non-significant F ratios at either the 1 per cent level or the 5 per cent level, t-tests were performed; no significant t's were found at the 1 per cent level; significant t's for the 5 per cent level were found for Trials 8 and 20. When significant F's were found, the variance of the experimental group was less than the control group on Trial 17. When significant t's were found, the direction was in terms of less time for the experimental group on Trials 8 and 20.

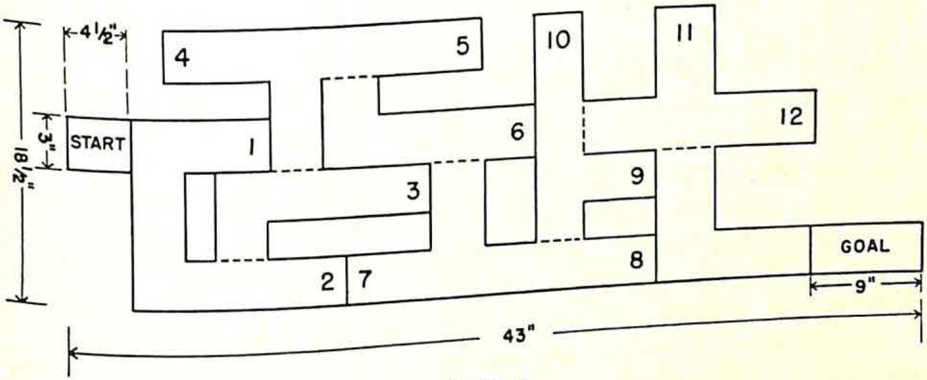

FIGURE 1
Illustrates the Maze Pattern

For errors, significant differences between the variances were found at the 1 per cent level for Trials 15, 16, and 18; no significant differences were found at the 5 per cent level.

For trials with non-significant F ratios at either the 1 per cent level or the 5 per cent level, t-tests were performed; significant t's at the 1 per cent level were found for Trials 8 and 19, and significant t's for the 5 per cent level were found for Trials 2, 6, 12, and 20. When significant F's were found, the variance of the experimental group was less than the control group on Trials 15, 16, and 18. When significant t's were found, the direction was in terms of greater errors for the experimental group on

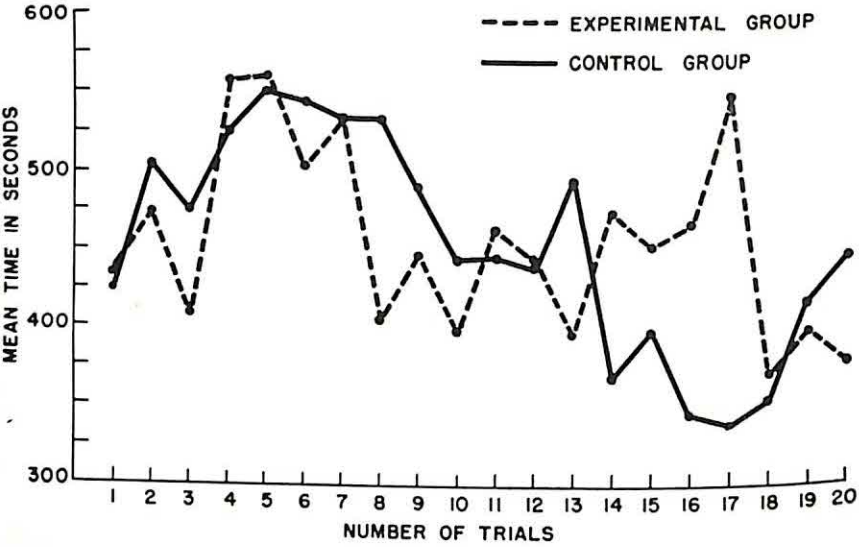

FIGURE 2
GIVES THE MEAN TIME IN SECONDS FOR BOTH THE EXPERIMENTAL GROUP AND THE CONTROL GROUP

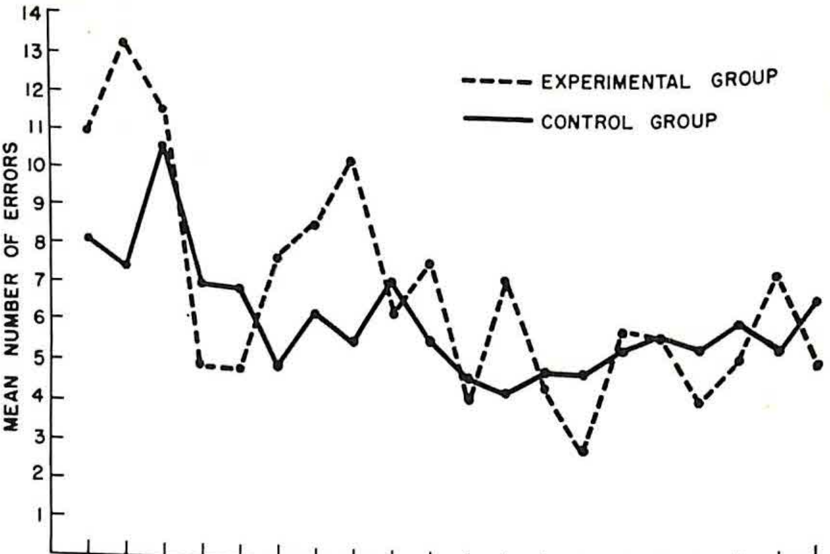

FIGURE 3
GIVES THE MEAN NUMBER OF ERRORS FOR BOTH THE EXPERIMENTAL GROUP AND THE CONTROL GROUP

Trials 2, 6, 8, 12, and 19, and less errors for the experimental group on Trial 20.

The error curves here are similar to those reported by Caldwell and Richmond in that for the experimental group, they would descend and then ascend and then drop again. This ascending phase was somewhat similar to the error curves reported by Caldwell and Womack (2).

D. Summary and Conclusions

The purpose of this experiment was to investigate the rôle of geotropism in the maze performance of golden hamsters.

The experimental group consisted of 12 golden hamsters who were subjected to a maze tilted at an angle of 21 degrees. The control group consisted of 12 animals who were subjected to the same maze pattern with a zero degree angle of inclination. *F* tests and *t* tests were applied to the differences between the two groups with the following results:

1. When comparisons were made for the times required to run the maze, statistically significant differences were found at the 5 per cent level for Trials 8, 17 and 20.
2. When the number of errors were compared, the results showed differences significant at the 5 per cent level for Trials 2, 6, 8, 12, 15, 16, 18, 19, and 20.

Although in general, the experimental group made more errors than did the control group, it should be noted that the experimental curve of errors showed an ascending-descending characteristic similar to those reported by Caldwell and Richmond and by Caldwell and Womack.

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ITEM ORDER AND DIFFICULTY IN FOUR VERBAL SUB-TESTS OF THE BELLEVUE-WECHSLER SCALE*

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A. PROBLEM

In the clinical situation where specific test objectives exist, even the frequent administration of the interview type of intelligence test may fail to reveal to the examiner certain unexpected group patterns of item response. Because during a brief but intensive period of testing such unexpected patterns of response seemed to appear, the information, similarities, comprehension, and arithmetic sub-tests of the Bellevue-Wechsler Intelligence Test for 60 subjects were examined for item order and difficulty.

B. PREVIOUS STUDIES

In the 1945 summary of research in the Bellevue-Wechsler scales, Rabin (4) presents no studies dealing with item-order in the sub-tests. In their more recent review, Rabin and Guertin (6) discuss only two dealing with the four sub-tests here considered. Rabin, Davis, and Sanderson (5) report some departures from the author's order of difficulty, and Jastak (2) finds his results quite at variance with Wechsler's. He cites several advantages for an improved progression: (*a*) economy and ease of administration, (*b*) setting reasonable limits of individual testing, and (*c*) deriving clinically meaningful measures of intratest scatter.

Wechsler himself, in the third edition of *Measurement of Adult Intelligence* (10), indicates a change in the order of questions in the information test based on supplementary data.

C. THE EXPERIMENTAL GROUP

During 1949, 60 adults from northeastern Indiana, ranging in age from 18 to 58 and averaging 13 years of schooling (only 2 with less than 12 years) yielded a mean verbal *IQ* of 114* (*SD* 9.5) on the Bellevue-Wechsler Scale.[1]

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[1] For 48 of this group for whom Otis *S-A* Test of Mental Ability, higher Form *B* scores are available, the range was wider (*SD* 12.7), the mean decreased to 105. Since, according to Hovland and Wonderlic (1), this form of the Otis is too easy for adults, the *B-W* average of 114 must be considered extremely generous.

D. RESULTS

1. *Information*

In his discussion of the information test, Wechsler observes that range of information certainly depends on education and cultural opportunity, but this objection, though valid, is not necessarily a fatal or even a serious one. Whatever the validity of this conclusion, other factors such as the universality of the question or the influence of historical conditions may alter the difficulty of the item and obliterate its merits as a choice from a random universal sample of a given level of knowledge.

TABLE 1
INFORMATION FAILURES, SUCCESSES AND RANK ORDER

			No. passed	No. failed	Rank
(1)	1.	pres.	60	0	1, 2 or 3
(5)	2.	therm.	60	0	1, 2 or 3
(4)	3.	rubber	51	9	10
(2)	4.	London	60	0	1, 2 or 3
(3)	5.	pints	55	5	6 or 7
(6)	6.	weeks	57	3	4
(7)	7.	cap. Italy	43	17	13
(16)	8.	cap. Japan	44	16	12
(9)	9.	weight wom.	53	7	9
(10)	10.	airplane	56	4	5
(12)	11.	Brazil	55	5	6 or 7
(11)	12.	N. Y.-Paris	28	32	17 or 18
(17)	13.	heart	50	10	11
(13)	14.	Hamlet	54	6	8
(18)	15.	U. S. pop.	21	39	19
(8)	16.	Wash. birth.	37	23	16
(14)	17.	N. Pole	12	48	21
(20)	18.	Egypt	28	32	17 or 18
(19)	19.	H. Finn	42	18	14
	20.	Vatican	39	21	15
	21.	Koran	16	44	20
	22.	Faust	10	50	22 or 23
	23.	hab. corp.	10	50	22 or 23
	24.	ethnology	4	56	24 or 25
	25.	apochrypha	4	56	24 or 25

Table 1 presents the 25 questions on the information test in the order now used, in the left-hand parentheses the order as given in the first and second editions, the number of failures and successes in the present group, and the corrected item order for this group.

That the group was consistently successful in the first question is evident. Yet it must be remembered that a question concerning the previous presidential incumbent has been, since Roosevelt's death in 1945, probably the easiest posed to an American above the age of five. Just prior to his death, for the 18-year-olds in the present sample, this question might have proved too difficult for first place in the series. At this writing (1953) it is again suitable; its suitability is, however, undependable.

Except for Item 3, the ranking of the six accords reasonably well with the given order. With the increasing production of synthetic rubber and the use of trade names such as "latex" associated with its commercial exploitation, some confusion seems to have arisen in Item 3. It no longer presents the simple situation of its original presentation. Since Wechsler himself remarks that "Where is London" discriminates between mental defectives and the borderline group, it might reasonably precede even Item 2 which requires more than a one-word answer and a certain degree of formulative ability as well.

Wechsler observes that in different localities the item-order will be somewhat altered. Item 7 will fare better among Italian-Americans, 8 among Japanese-Americans, perhaps 14 among Britons. The population in question, however, is a homogeneous group somewhat above the average in schooling and intelligence (according to this test) and fairly characteristic of much of the American population outside the largest cities.

Wechsler has noted that relatively few Americans approximate the country's population and the present writer finds even well-informed persons curiously indifferent to population statistics. In this instance the failure is the more striking since in the Fall of '49 the newspapers were full of population data in anticipation of the 1950 census. This lack of quantitative interest appears in Item 12 as well. For this group Items 10 and 11 were less troublesome than were the capitals of Italy and Japan, even though the use of "Tokyo" for Japan and "Rome" for Italy had appeared constantly in war communications.

Without doubt Item 14 has been affected by the large-scale promotion of Olivier's Hamlet. This and Item 19 for the same reason probably no longer signify cultural knowingness. The nearness of Indiana to Missouri may account, too, for this group's possessive interest in Mark Twain. On the other hand, the bi-centennial of Goethe's birth celebrated at Aspen, Colorado, in 1949 which took place a few months before these tests were administered, presumably had little effect despite the publicity.

To Item 17, where an answer of any kind was forthcoming, Byrd was the popular choice. About the acceptable answer, "Peary," it might be observed that a point so critically discussed as late as October, 1951 (9), can hardly be considered a good choice from a universal realm of unassailable fact. *Time* Magazine in 1949 (8), reviewing the Peary controversy briefly, says:

> In Manhattan, the Rev. Bernard R. (The Glacier Priest) Hubbard disclosed that the U. S. Air Force recently took a "fix" of the North Pole with loran (long-range navigation) beams aimed from Alaska to intersect at the 90th meridian. U. S. Air Force planes had circled the North Pole 300 times, taking photographs of the spot marked by the crossing electronic beams. "Where the Pole should be," he announced, "there is only a nightmare jig-saw puzzle of ice floes. . . . I won't say it's impossible that Peary reached the actual Pole, but it's extremely improbable."

In 1951, *Life* Magazine (3), in an article on Peary, uses the sub-title: *Six men and 38 sledge dogs finally made it to the Pole.* This would indicate an acceptance of Peary's claim. Yet, where so much controversy still exists, the well-informed subject might be considerably more confused than the less inquiring who learned something at school and thereafter never observed anything to awaken his doubt.

These subjects, all of whom indicate church affiliation (7) (though comprising proportionately fewer Catholics than exist in the community) found Item 20 less demanding than did the standardization population. The 21st question seems to indicate a well-insulated interest in comparative religions, and for a church-going population, the struggle with Item 25 is somewhat surprising.

For testing the significance of these differences by Chi-Square, 10 deviant items in all combinations were compared: 3, 7, 8, 10, 11, 12, 13, 15, 17, 20. Applying for 60 subjects significance values .10 = 2.71, .05 = 3.84, .02 = 5.41, .01 = 6.64, and .001 = 10.83, then Item 7 is more difficult than 11 (6.26), 8 more difficult than 11 (7.5), 12 more difficult than 13 (18.1) or 20 (10.2); 15 more difficult than 20 (12.9); 17 more difficult than 20 (25.7). Application of Chi-Square to the permutations of all 25 question scores might reveal more misplacements than appear above.

As interesting as these conclusions are the relative significance ratios for both close and widely separated items: Items 7 and 8, 7 and 20, 8 and 20, 10 and 11, 3 and 13, 0.0; 3 and 11, 11 and 13, 8 and 10, 0.75; 7 and 13, 1.0; 8 and 3, 1.8; 8 and 13, 1.2; 3 and 0, 1.23; 12 and 15, 1.06; 11 is easier than 12 (28.0), easier than 15 (32.2), than 20 (8.4). Question 10 is easier than 12 (26.7), than 13 (2.0), than 15 (31.6), than 17 (54.7), than 20 (9.3). Such fluctuations, conspicuous throughout all combinations of the 10 tested items show extreme unevenness in the progression of difficulty.

It would seem then that even among the 10 questions tested for deviation there are several misplaced and wide differences in degree of difficulty from question to question. Both of these might seriously undermine the confidence of the testee.[2]

2. *Comprehension*

Though there is still some question as to what aspect of intelligence the comprehension test measures, Wechsler justifies its inclusion on the ground that it appears in other accepted tests; that administered orally and individually as it is, it provides cultural background indices as well as psychiatric diagnosis. In the present sample no bizarre responses occurred and the analysis is confined to success and failure.

TABLE 2

COMPREHENSION FAILURES, INFERIOR AND SUPERIOR RESPONSES, TOTAL SUCCESSES, RANK ACCORDING TO TOTAL SUCCESSES AND ACCORDING TO TOTAL SUCCESSES AND SUPERIOR RESPONSES

	No. passed	Sup. resp.	Inf. resp.	No. failed	Rank, No. passed	Rank No. passed and sup. resp.
1. envelope	59	58	1	1	1	1
2. theater	55	47	8	5	3	2
3. bad comp.	54	45	9	6	4	3
4. taxes	49	27	22	11	6	5
5. shoes	59	26	33	1	2	4
6. city land	43	19	24	17	8	8
7. lost woods	46	23	23	14	7	7
8. laws	51	6	45	9	5	9
9. marriage	22	9	13	38	10	10
10. deaf-talk	42	31	11	18	9	6

In Table 2 appear the number of failures, the number of 1 and 2 responses, and the total of these two, the ranking for the experimental group according to number passed and to both number passed and number of superior responses.

With Item 4 the number of superior responses breaks sharply (perhaps an expression of affect). Only one person failed to find even one acceptable reason for the choice of leather for shoes and the question seems both misplaced and in need of rewording. (What is its fate in terms of the increasing use of synthetics?) Number 8, why laws are necessary, showed three-quarters of the group conversant with the need, few of them unable to find a good reason, but only six able to formulate a superior level response. Despite a nearly equal number of superior responses, Question 9 proved immensely more challenging with 38 failures, largely due to an emphasis on "morality," and more difficult than 10. Judged by superior responses alone, Items 4, 5, 6, 7, and 10 form a cluster, sharply demarked from the first three and from 8 and 9.

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[2] It is suggested that the interpretation of correct responses not be left to the examiner. Wechsler's population limit figures require extension upward and his answer for Item 24 that "Ethnology is the study of the origin of races" might be broadened to the dictionary definition: "Ethnology is the science of the races of men and of their character, history, customs, and institutions."

When tested by Chi-Square, Items 4, 5, 6, 8, 9, and 10, in all combinations show that Item 9 is significantly more difficult than 10 (12.9), 4 more difficult than 5 (6.7). Again there seems to be no consistent degree of difficulty from item to item: 9 is more difficult than 5 (36.0), than 6 (12.2), than 8 (22.1). Items 2 and 3 show no difference (0), 6 and 8, 1.2; 4 and 10, 1.4; but 10 is more difficult than 5 (16.1), and 8 (3.05).

For this group success according to total passing each question would produce this ranking: 1, 3, 4, 6, 2, 8, 7, 5, 10, 9. If both number passing and superior responses are considered:[3] 1, 2, 3, 5, 4, 8, 7, 9, 10, 6.

3. *Arithmetical Reasoning*

For this relatively well-endowed and educated group, the arithmetic sub-test, compared with other sub-tests, proved too easy. Of 60 subjects, 17 achieved a raw score of 10 or more, or an accurate response to all questions.

TABLE 3
ARITHMETIC REASONING FAILURES, SUCCESSES, AND RANK ORDER

	Number passed	Number failed	Rank order
1. 4 and 5	60	0	1, 2, 3, or 4
2. 10-6	60	0	1, 2, 3, or 4
3. 25-8	59	1	5 or 6
4. oranges 36/4	58	2	7
5. hrs.-24/3	60	0	1, 2, 3, or 4
6. stamps, 2, 7	60	0	1, 2, 3, or 4
7. 7/25, lbs.	59	1	5 or 6
8. car, $400, 2/3	43	17	8
9. 150 yds., 10 sec.	34	26	9
10. 8 men, 6 days	28	32	10

Table 3 shows little challenge or discriminative power for this group in the first seven questions. Item 8 is sharply demarked from the preceding seven by a new level of difficulty; the last three ascend satisfactorily in the degree of reasoning difficulty involved. Yet even No. 10 was failed by only half the group. A test of significance does not seem to be indicated here.

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[3] Question 2 is probably affected in many communities by periodical fire-prevention campaigns in moving picture theaters. For Question 7 it is suggested that the watch-as-compass solution used by scouts and taught in the military services be included among the acceptable responses.

4. *Similarities*

Wechsler considers the similarities sub-test among the best of the battery, yielding a large amount of "*g*."

TABLE 4

Similarities Failures, Inferior and Superior Responses, Total Successes, Rank According to Total Successes and According to Total Successes and Superior Responses

	No. passed	Sup. resp.	Inf. resp.	No. failed	Rank No. passed	Rank No. passed and sup. resp.
1. or-ban.	60	60	0	0	1	1
2. coat-dress	60	53	7	0	2	2
3. dog-lion	56	46	10	4	5	3
4. wag.-bicyc.	59	31	28	1	4	4
5. pap-radio	60	7	53	0	3	5
6. air-water	40	21	19	20	9	9
7. wood-alch.	21	3	18	39	12	12
8. eye-ear	48	28	20	12	6	6
9. egg-seed	47	26	21	13	7	7
10. poem-stat.	45	25	20	15	8	8
11. praise-pun.	38	11	27	22	10	10
12. fly-tree	24	14	10	36	11	11

As in Tables 2 and 3 items show a tendency to cluster in groups of conspicuously distinctive difficulty. Between Items 5 and 6 the difference is large, even between 5 and 8, where success was greater. Excluding Item 7, which is strongly aberrant, 6, 8, 9, and 10 constitute a group whose total and superior successes are not widely different. Items 7 and 12 can also be grouped together, forming a third unit of strikingly greater difficulty.

Item 5 is outstanding in the small number of superior responses. Nearly the entire sample emphasized the news-giving likeness of newspaper and radio. From the point of view of number of outright failures and superior successes, Question 7 seems the most difficult in the series. Requiring for a superior answer that wood and alcohol are both organic substances or hydro-carbons, the answer leans (as does Item 6) more heavily on technical education than do the others, making it different not only in degree but in kind.

Chi-Square, applied to Questions 4, 5, 6, 7, 8, 9, 10, and 12, shows Question 7 to be more difficult than 8 (18.9), than 9 (17.3), than 10 (16.7), roughly as difficult as 12 (0.41). Though 4 and 5 are adjacently ranked, there is a wide gulf in difficulty (15.6), also between 5 and 6 (17.1), much smaller between 5 and 8 (7.4).

About the same are 6 and 10 (0.05), 8 and 9 (0.0), 9 and 10 (0.64); 6 and 9, 6 and 8, and 8 and 10 are hardly distinctive (1.2).

E. SUMMARY

For a group of 60 adults, age 18 to 58, with an average schooling of 13 years and mean *IQ* 114 (range 98-138), four of the Bellevue-Wechsler verbal sub-tests are examined for item-order and difficulty.

The information, comprehension, and similarity tests reveal item-order discrepancies, a tendency for items to cluster in groups of similar difficulty, an abrupt augmentation of difficulty from group to group, and extreme fluctuations in difficulty from item to item.

The arithmetic test proved too easy for this sample of normal adults with few failures on the first seven questions. Only the last three problems conspicuously challenged or differentiated ability and Item 10 was passed by half the group.

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A COMPARISON OF THE INTERESTS OF ENGLISH AND AMERICAN SCHOOL CHILDREN*

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A. Problem

It is unfortunate that differential psychology, as it has developed during the last two or three decades, has been very largely an American product. Particularly in the field of interest measurement, where the work of Strong, Kuder, and others has given us a considerable body of information about how likes, dislikes, and preferences are organized in American students and adults, we lack comparable data for cultures differing to varying degrees from our own. If we wish to go beyond empirical predictions and use the information we have as part of an inclusive theory of human motivation, it will be necessary to make such comparative studies. This paper is a report of one such attempt.

B. Subjects and Test

The present investigation used as subjects 95 children, 46 boys, and 49 girls, one entire class in a primary school at Hendon, England, a northern suburb of London. The great majority were 10 and 11 years of age, about comparable with American fifth graders. Since data were being collected at about the same time for other kinds of research on children's interests, several American groups were available for comparison purposes. They were as listed in Table 1. All groups were drawn from schools in neighborhoods without extremes of wealth or poverty. They represent three widely separated regions in the United States. The two sets of data for Oregon fourth grades make possible a judgment as to how consistent group findings are from year to year.

The test was the Dreese and Mooney Interest Inventory for Elementary Grades. Similar in form to the well-known Strong Vocational Interest Blank, it asks the child to register a judgment of Like, Indifferent, Dislike,

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[1] I should like to express my appreciation to Professor P. E. Vernon of the Institute of Education, University of London, who helped me make arrangements for this study. I also wish to thank Mr. N. F. H. Butcher, Borough Education Officer at Hendon, and Mr. A. S. Downing, Principal of Deanbrook School, without whose friendly coöperation the work could not have been done.

or Unknown to each of 237 items. These are grouped into sections on Reading, Movies, Radio, Games and Toys, Hobbies, Things to Own, School Subjects, People, Occupations, and Activities. There are also 13 items of the preference or choice type which were not used in this analysis of *L*, *I*, and *D* responses.

TABLE 1
GROUPS OF CHILDREN WHO FILLED OUT THE INTEREST INVENTORY

Boys	Girls	Grade	City	Date of testing
103	105	4th	Eugene, Oregon	1949-51
62	50	4th	Eugene, Oregon	1952-53
41	48	5th	Eugene, Oregon	1952-53
38	38	6th	Eugene, Oregon	1952-53
55	51	4th	St. Paul, Minnesota	1952-53
44	42	5th	St. Paul, Minnesota	1952-53
44	56	6th	St. Paul, Minnesota	1952-53
51	36	4th	Elizabeth, New Jersey	1952-53
47	50	5th	Elizabeth, New Jersey	1952-53
62	55	6th	Elizabeth, New Jersey	1952-53

C. PROCEDURE

The questions around which the principal investigation was centered are these: Is there a greater degree of similarity between children in different parts of the United States than between one of these groups and English children? If there is, how large and important is the difference and how can we account for it?

The main findings are based on an item analysis leading to correlations between item percentages for different pairs of subgroups. The number of *L, I,* and *D* responses was tabulated separately for each subgroup. Regions, grades, and sexes were all kept separate for the purposes of this tabulation, so that it would be possible to compare, for instance, New Jersey sixth-grade boys with Oregon sixth-grade boys, or Minnesota fifth-grade boys with Minnesota fifth-grade girls. As a basic comparison group for the English-American study, the Oregon fifth graders were chosen, since they were similar in age and socio-economic level to the English subjects, and previous research had familiarized me with their general characteristics. Resemblances between the Oregon fifth-grade group and the English group were then compared with resemblances between this group and the other American groups.

For assessing these resemblances, *L* percentages to the test items were correlated. An *L* percentage can be considered a sort of "popularity index" for the activity to which it applies. The nature of the basic data entering into the correlations can be illustrated as shown in Table 2. It is evident that the N for such correlations is the number of *items* rather than the number of persons. This N was reduced to 218 for the boys and 209 for the girls by the omission of a few items marked U by more than one-fourth of the English subjects and a few others where the failure of the L, I, and D percentages to sum to approximately 100 indicated that some error must have occurred either in the marking of the paper or in the machine tabulation.

TABLE 2
ILLUSTRATION OF TYPE OF DATA ON WHICH CORRELATIONS ARE BASED

Item	English boys L%	Oregon boys L%
1. Adventure stories	91	90
2. Animal stories	72	68
3. Books about hobbies	48	46

In addition to the correlational study, three supplementary analyses of the data by other methods were made in the hope of throwing light on the meaning of the principal results. They were: (*a*) A study of the items showing significant sex differences in the English and American groups. (*b*) An examination of specific responses showing significant differences between regional groups and between nationality groups. (*c*) A study based on the total numbers of L and D responses given by individuals and a check on the statistical significance of differences in the means of these L and D scores.

D. PRINCIPAL RESULTS

The correlational study showed a large amount of agreement between groups of the same sex regardless of geographical location. Table 3 shows these correlations between the Oregon fifth-grade group and the groups in other places.

It can be seen that while all r's are high, those between regions within the United States are higher than those between the United States and England. Furthermore it would appear that the closer together the regions are

TABLE 3
CORRELATIONS BETWEEN L PERCENTAGES FOR EUGENE 5TH GRADERS AND OTHER GROUPS

	Boys $^*N = 218$	Girls $^*N = 209$
Eugene, Oregon vs. Hendon England	.79	.81
Eugene, Oregon vs. Elizabeth, New Jersey	.84	.87
Eugene, Oregon vs. St. Paul, Minnesota	.86	.89

*N represents number of items rather than number of subjects. Percentages are based on approximately 50 persons in each group.

the higher their correlations turn out to be. The second conclusion is somewhat doubtful, however, as the *z* test shows that the differences between .84 and .86 and between .87 and .89 are not significant at the 5 per cent level. Both of the differences between the English and Minnesota correlations, and the one for girls between England and New Jersey, are significant.

Table 4 gives some other correlations which serve as background against which to interpret the figures in Table 3. All of the correlations between comparable American groups turn out to be somewhere between .84 and .89 whether they refer to different regions, different grade levels, or different years. When the percentages for girls are correlated with those for boys, however, the coefficients obtained are much lower. The two figures show a remarkable similarity also, .46 in Oregon, .47 in England. To summarize, the order of popularity of various children's activities is very similar in England and the United States, but different regions in this country are even more similar. Groups of boys are much less like groups of girls in their own community than they are like other groups of boys thousands of miles away.

TABLE 4
Correlations between *L* Percentagges of Various Groups

	Boys	Girls
Eugene 6th vs. Elizabeth 6th	.87	.87
Elizabeth 4th vs. Elizabeth 6th	.85	.89
Eugene 4th (1949) vs. Eugene 4th (1952)	.85	.87
Eugene 4th, Girls vs. Boys	.46	
Hendon, England, Girls vs. Boys	.47	

E. Supplementary Analyses

There are of course many ways in which data like those we have collected could be analyzed. The methods I chose were those which seemed most likely to throw light on the meaning of the correlations.

In the first place, the sex differences were examined, item by item, for the English group and for the fifth-grade Eugene group. In the English group there were 82 items on which a clearly defined sex difference appeared; in the American group there were 80 such items. Sixty of these were common to the two nationality groups, and in general the others were those on which percentage differences were not very large, although they were significant at the 5 per cent level. It is a noteworthy fact that there is only one of these 60 common items where the *direction* of the difference is reversed for the two groups. "Drawing" tends to be a masculine activity in England, a feminine one here. In the 59 other instances, the direction of the sex difference is the same in England as in Oregon. There is also a tendency for the percentage difference between boys and girls to be *greater* in England. Since with this age group sex rôles seem to constitute one of the principal organizing factors for likes and dislikes, the similarity of the sex differences in England and the United States may well account for the general similarity of interest pattern which Table 3 indicates.

The second type of supplementary analysis tested the significance of differences in individual item response percentages between English and Oregon boys and between English and Oregon girls. The items giving significant differences between various American groups were also selected. The thing which showed up most clearly as a result of this procedure was what might have been anticipated from the correlations—there are *more items* giving significant differences between Eugene and Hendon than between Eugene and either St. Paul or Elizabeth. It seems unnecessary to present all these item comparisons in detail. The findings can be summarized simply by saying that about half of the items show enough difference between England and Oregon to be significant at the 5 per cent level, whereas about one-fourth made significant differentiations between comparable American groups in the different localities.

When we try to draw some conclusions about the types of responses involved, only one fact stands out. For the large majority of the items that were selected the English children register *less liking* or *more disliking* than did the Americans. There are only a very few exceptions. English boys like clay modeling better than American boys do, and English girls are more enthusiastic than American girls about several kinds of movies, playing with blocks, going to parties, gardening, and sewing. Otherwise the trend is in the other direction, with American children liking everything more.

The third supplementary analysis furnishes further evidence for this same point. When papers are scored for total numbers of likes and dislikes, comparisons of mean L and D scores for English and American groups show clear-cut significant differences. When we compare the means for the Hendon group with those for the Eugene fifth grade, all t values are significant at the 5 per cent level. Differences in average D scores are larger and more significant than differences in L. Furthermore, the average D scores for the English group are significantly higher than those for *any* of the other American groups in different grades or different localities. This consistent tendency to give the D response more, the L response less, stands out with special clarity because none of the American groups differ significantly from one another in this regard.

F. Interpretation

The first and most important finding, that there is a high degree of similarity between the interest patterns of English and American children, requires no particular elucidation. What little evidence we have about somewhat similar traits in adults points in the same direction. Strong (2) reports an unpublished study by Pallister and Pierce which indicates that groups of Scottish artists, policemen, and ministers make interest scores that are quite similar to those of comparable American groups. Eysenck (1) has shown that primary social attitudes follow similar patterns in the United States, England, Germany, and Sweden. If there are differences between England and America in attitudes toward child rearing and education, as many persons in both countries have assumed, they are not apparently affecting children's interests to any great degree. The fact that sex differences are so very similar in the two countries is a fact of some importance.

In accounting for the second finding, that there is somewhat more difference between English and American children than between different American groups, the only clue that stands out is the greater tendency of the English to register Dislikes. Three ways to explain this fact suggest themselves. The simplest and most obvious is that American children, perhaps because of some consistent influence in home or school, are more enthusiastic about things in general than the English children are. The second is that there may be an American bias in the selection of children's activities that make up the interest blank, a bias that is not corrected by simply omitting items with which English children are not familiar. The third possibility is more tenuous and grows out of research reported in another paper (3). It has been shown there that patterned interests depend upon the development of dislikes, which seem to be to some extent an indicator of maturity, of knowing what one is and what one wants. It may be that the structure of his psychological world is typically a little clearer for the English than for the American child. He is brought up to "know his place," and thus sees more things as inappropriate for him. The fact that the sex differences are somewhat wider and more decisive there would also support this view. It is, however, highly speculative at present and would need to be corroborated by other sorts of evidence before it could be taken very seriously.

G. Summary

1. The Dreese and Mooney Interest Inventory for Elementary Grades was administered to 95 10- and 11-year-old English children and to similar age groups in western, midwestern, and eastern cities of the United States.

2. Correlations of about .8 between item percentages indicate that there is a considerable degree of similarity between English and American children.

3. Correlations of .84 to .89 between item percentages point to a still greater degree of similarity between American groups in different sections of this country.

4. Correlations of .46 and .47 for boys vs. girls in the American and English groups respectively show that sex groups are considerably less like one another than nationality groups are.

5. Analyses of individual item differences for the sexes show that in general the sex differences follow the same pattern in both countries.

6. Analyses of individual item differences between nationality groups, as well as comparisons of average *L* and *D* scores, indicate that there is a consistent tendency for English children to like fewer things and dislike more things than American children do.

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A STUDY OF A METHOD OF APPRAISING SELF-ACCEPTANCE AND SELF-REJECTION*[1]

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This report deals with the development of an instrument for measuring certain aspects of self-acceptance and self-rejection. The instrument, which is here reproduced, consists of a 132-item response-form.

A. UNDERLYING ISSUES

Many specific questions are raised in the literature regarding the relationship between so-called self-accepting and self-rejecting attitudes and problems of individual development and human relationships. The solutions to such questions would be of great interest and value to the psychologist and to the educator. But to make a beginning in finding answers to some of the many questions a research technique for studying aspects of self-acceptance–self-rejection is required.

The self-accepting person has been said to show characteristics such as the following: He respects himself and lives comfortably with himself. He is able to recognize his own wishes, hopes, fears, and hostilities and to "accept" his emotional tendencies, not in the sense that he is smugly self-approving but in the sense that he has freedom to be aware of the nature of his feelings. By the same token, he is freer to make decisions of his own, to assume responsibility for them. He "likes" himself and feels that others find qualities in him that are likeable. His positive self-regard has a tenacity of its own and does not rise and fall indiscriminately in keeping with the praise or criticism he receives from others. By contrast, the self-rejecting person has been regarded as having characteristics such as the following: He "dislikes" himself. He tends to be self-derogatory and to condemn himself. His self-regard vacillates in keeping with attitudes others direct or seem to direct toward him. He is likely to feel that other persons view him with hostility and disparagement. He does not feel free to draw upon or to trust his own feelings and attitudes. He tends to have a grudging attitude toward himself, as expressed, for example, in an unwillingness to spend money on himself.

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[1] This is a posthumous report of a study on which Mrs. Spivack was working when she died. The study has attracted considerable interest and her dissertation committee, consisting of Dr. Anne McKillop, Dr. Robert L. Thorndike, and the undersigned agreed that it would be well to publish a statement of it. The material here presented is based upon a statement prepared for a seminar presentation. The statement leaves several theoretical questions unanswered, and several statistical operations unfinished. Had Mrs. Spivack lived she probably would have revised and reedited her instrument and she was interested also in adapting it to other age levels. Although unfinished, the study presents a structure upon which other students can build. This article was prepared by the undersigned and is being published as a project related to his own research on the subject of the self under the auspices of the Horace Mann-Lincoln Institute of School Experimentation.—*Arthur T. Jersild*

The study raises two questions and, subject to the answer found to the solution of these, several ancillary questions.

1. Can the consciously recognized facets, evaluations, and conceptions of the self that purportedly relate to "self-acceptance–self-rejection" be incorporated into a response-form for self-description that is statistically reliable and internally consistent?

2. Are the evaluations, facets, and conceptions of the self that might be incorporated into such a response-form classifiable into distinct components? Do they constitute clusters of ideas and attitudes pertaining to the self that are logically or psychologically differentiated from each other in a manner that can be demonstrated statistically, or, does so-called "self-acceptance–self-rejection" represent so pervasive a condition that it appears similarly if approached in different ways (e.g., when approached in terms of a cluster of items dealing with feelings of not being respected by others, another cluster dealing with feelings of inequality with others, another dealing with distrust of self, etc.)?

Ancillary questions is this study deal with such factors as age differences, the relation of self-ratings on self-acceptance–self-rejection instrument to school marks, ratings by teachers, and the like.

A statistically reliable and internally consistent response-form of the kind that the present study endeavors to develop might ultimately be a useful research tool in the study of problems pertaining to the meanings and ramifications of the concept of self-acceptance.

B. Subjects and Administrative Procedures

Six hundred and ninety high school boys and girls of two age groups participated in this study. The respective average ages of the two groups of boys were 17.28 years and 14.34 years; of the girls, 16.97 years and 14.50 years. The children included 280 twelfth grade boys; 98 ninth grade boys; 197 twelfth grade girls; and 115 ninth and tenth grade girls.

1. *The Response-Form*

a. The items. The plan in developing the instrument was to use verbal expressions of facets, conceptions, characterizations, and evaluations of the self that purportedly represent consciously formulated ideas and attitudes denoting acceptance or rejection of self. The major though not the only sources for the items were found in the works of Horney (2, 3, 4, 5), Rogers (8, 9), and Sheerer (10).[2]

The items were prepared in pairs—each "self-accepting" item having its "self-rejecting" counterpart. A person accepting one description as fitting himself, would, if he responded consistently, reject the characterization given in the counterpart of this item.

In order to make it easier for most persons to find a characterization in keeping with their own conception of themselves than would be possible if only extremes of self-acceptance or self-rejection were included an effort was made to have the items involve degrees of acceptance and rejection, to the extent that this can be done on the basis of the judgment of one person. Within groups of six items closely related in content, two were prepared to represent extremes of self-acceptance or self-rejection, two represented intermediate degrees of self-acceptance and two represented intermediate degrees of self-rejection.

As far as possible, the items were phrased in simple terms. The phrasing that ultimately was used seemed to serve quite well but it probably could be improved to a great extent.

On the basis of these considerations, a response-form of 132 items was prepared. The items were arranged in random order.

A copy of the Spivack Response-Form for Appraising Self-Acceptance–Self-Rejection follows, with the addition, in the right-hand margin, of a key showing whether the item represents self-acceptance (+) or self-rejection (—) and indicating the number of the counterpart of each item (Table 1).

2. *Administration of the Response-Form*

The response-form was administered to classroom groups by the investigator. The children were asked not to record their names. The form made provision for three different response choices on each item: (*a*) "That's like me"; (*b*) "That's not like me"; (*c*) "?." The subjects were instructed to place a check mark either in Column 1 or in Column 2; they were told also to place a check mark in Column 3 if they wished to qualify their answer.

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[2] References to published and (at the time) unpublished studies which the investigator drew upon are listed at the end of this paper.

TABLE 1

THE RESPONSE-FORM

GRADE (please check) DATE ______________________
Month Day Year

Fresh. Soph. Jun. Senior

Upper ______________________ DATE OF BIRTH ______________________
Month Day Year

Lower

HIGH SCHOOL ______________ AGE ______________ SEX ______________

We are asking you to assist in a research study that involves a method of learning how people feel about themselves.

The information that you write in the blank spaces above is intended to give us some idea of the groups helping in this study. We do not ask for your name; therefore, please do not write it in. We do not want to identify any individual persons. Please fill in the blank spaces above, now.

On the pages that follow are a series of statements. Read each statement carefully and then place a "check mark" (√) either in Column (1) or in Column (2), that is, either in the column headed "that's like me" or in the column headed "that's not like me." If a statement does not seem to apply to you, or if it is difficult for you to decide whether to check in Column (1) or Column (2), check also in Column (3), the "question mark" column. *But be sure to check in either Column (1) or Column (2) to show which is most nearly correct for you, regardless of whether you check in the "question mark" column or not.*

There are no "right" or "wrong" answers. Any answer that is "correct" for you is a "correct" answer. Try to be sure, therefore, that every answer is the true one for you, so that your help may be valuable for this study.

Please read each statement carefully, but do not stop to think very long. Work as fast as you can; make sure you do not skip any statement. When you have finished one page, go on to the next, until you have finished the whole booklet. Do not take the time to go back to parts already finished. Do not write your name anywhere in this booklet. This information is entirely anonymous and no one here in school will know how you answered. Thank you. Go ahead.

	That's like me (1)	That's not like me (2)	? (3)	Key
1. When it seems to this person that he has made a bad impression, he usually feels that he will be able to set right again the opinion the other person has of him.	___	___	___	+, 68−
2. This person often feels that other persons say unfriendly things about him behind his back.	___	___	___	−, 67+
3. This person always knows when his ideas are worth while, even if no one tells him that they are good.	___	___	___	+, 100−
4. This person hesitates to begin new things because he's afraid he might fail.	___	___	___	−, 86+

TABLE 1 (*continued*)

	That's like me (1)	That's not like me (2)	? (3)	Key
5. Much of the time this person feels pretty sure that someone will love him.	____	____	____	+, 120—
6. Whenever this person does something that is only for his own benefit, he feels that maybe he is being selfish.	____	____	____	—, 74+
7. This person often is annoyed with himself because he feels that he cannot change some of his feelings that he doesn't like.	____	____	____	—, 71+
8. This person feels that he usually knows pretty well the kind of life he wants for himself.	____	____	____	+, 76—
9. This person often feels that he will never amount to much.	____	____	____	—, 77+
10. When he meets anyone, this person feels that he must notice whether he is above or below the other person in this or that trait or quality	____	____	____	—, 125+
11. This person does not feel mixed up about himself.	____	____	____	+, 115—
12. This person sometimes has the feeling that maybe he is not better than some people feel he is.	____	____	____	—, 80+
13. This person sometimes worries when he finds that his feelings toward certain persons are a mix-up of love and hate.	____	____	____	—, 122+
14. This person always feels that he deserves his fun or recreation.	____	____	____	+, 97—
15. This person usually feels that he is pretty true to himself; he never feels that he is a "phoney."	____	____	____	+, 101—
16. This person feels that he will do as his friends do, even if it is against his own ideals, rather than take a chance on being slighted.	____	____	____	—, 87+
17. This person sometimes is very angry at himself because he feels that he cannot beat the odds against him.	____	____	____	—, 79+
18. This person usually tries to live up to his own ideals, even when he feels that his friends may slight him for it.	____	____	____	+, 126—
19. This person sometimes feels that in many things he is not as good as his friends.	____	____	____	—, 93+
20. When this person is working at a job or project, he usually feels confident of seeing it through.	____	____	____	+, 128—
21. This person does not want some people to know him too well; he feels that if they did, they might think he was just putting on a false front, just bluffing.	____	____	____	—, 106+
22. When people praise him, this person usually feels that they mean it.	____	____	____	+, 124—

TABLE 1 (*continued*)

	That's like me (1)	That's not like me (2)	? (3)	Key
23. This person always feels very much at ease with other people.	___	___	___	+, 127—
24. This person feels that there is something wrong or odd about him.	___	___	___	—, 114+
25. This person often is pretty discouraged about himself because he feels that some people do not respect him.	___	___	___	—, 131+
26. If he can't be sure of the way something will turn out, this person would rather let somebody else make the decision.	___	___	___	—, 94+
27. This person feels that some people are friendly to him only when they try to use him.	___	___	___	—, 98+
28. This person feels that he now has many of the qualities of the kind of person that he wants to be.	___	___	___	+, 88—
29. If people show a liking for him, this person feels that it is only because they don't see through him; they don't realize that he's bluffing.	___	___	___	—, 78+
30. This person feels that in most things he gets the "short end of the stick."	___	___	___	—, 96+
31. This person feels it is right that he should rest and take it easy for a while when he is tired.	___	___	___	+, 85—
32. This person feels guilty about things that don't seem to bother other people at all.	___	___	___	—, 99+
33. This person sometimes feels very discouraged about himself because he just can't see any good in himself at all.	___	___	___	—, 83+
34. This person continues to be upset by the memory of mistakes for a long time.	___	___	___	—, 90+
35. This person usually feels that his own ideas are as clever as the ideas of other people.	___	___	___	+, 116—
36. When some people criticize him, this person often feels that the fault is his and is upset over it for a while.	___	___	___	—, 119+
37. This person sometimes feels that the way he has been acting does not seem like him.	___	___	___	—, 121+
38. This person feels that he is better than most of his friends in the qualities that are really worth while.	___	___	___	+, 52—
39. This person often feels that he hasn't got what it takes to be respected by other persons.	___	___	___	—, 92+
40. This person likes to speak when he is with people; he usually feels that they like what he says.	___	___	___	+, 113—
41. This person does not feel that he has all of the faults that his parents have said he has.	___	___	___	+, 118—

TABLE 1 (*continued*)

	That's like me (1)	That's not like me (2)	? (3)	Key
42. This person can usually own up to himself that he has been in the wrong; he does not have to put the blame on something or someone.	___	___	___	+, 70—
43. When this person gives help to anyone, as long as he has been helpful, he does not worry himself with the feeling that maybe he did it to show the other person's weak points.	___	___	___	+, 102—
44. When things happen to go just right for him, this person has a feeling that somehow he is going to pay for this, that good things are not for him.	___	___	___	—, 89+
45. Sometimes this person's life seems so difficult that he feels it's just no use trying to overcome his many difficulties.	___	___	___	—, 123+
46. This person usually decides easily the things that come up in the course of the day.	___	___	___	+, 82—
47. This person feels that he likes to make the most of his good points.	___	___	___	+, 132—
48. This person often has the feeling that he must apologize to some people for having offended them, although he has not meant to offend them.	___	___	___	—, 84+
49. This person is discouraged and feels like throwing in the sponge when things are not going right.	___	___	___	—, 112+
50. This person usually feels that it is easy for him to get acquainted in a group.	___	___	___	+, 108—
51. When bad things happen to this person, he does not feel that he had it coming to him.	___	___	___	+, 117—
52. This person does not feel that he is better than most of his friends in the worthwhile qualities.	___	___	___	—, 38+
53. This person feels that most people like to have him around.	___	___	___	+, 129—
54. This person feels that he is pretty well able to keep people from bossing him.	___	___	___	+, 75—
55. Sometimes this person has a feeling of loneliness when he is among people of his own age	___	___	___	—, 72+
56. This person feels happy when he has acted by his own principles even when people criticize his actions.	___	___	___	+, 110—
57. This person usually does not expect people to "get him wrong," and he does not feel that he has to justify himself with them.	___	___	___	+, 109—
58. This person does what he can to control certain habits that he does not like, and he does not worry himself sick if he cannot control them.	___	___	___	+, 111—

TABLE 1 (*continued*)

	That's like me (1)	That's not like me (2)	? (3)	Key
59. This person is very hard on himself when he has failed at some job or project.	——	——	——	—, 105+
60. This person feels that he has as much to look forward to in life as many of his friends.	——	——	——	+, 103—
61. When he is all mixed up about a problem, this person feels that if he asked for suggestions or help, he would come down in the eyes of people.	——	——	——	—, 91+
62. This person often feels that people don't like to have him in their company.	——	——	——	—, 81+
63. This person usually does not feel that people like to say things just to hurt his feelings.	——	——	——	+, 107—
64. When this person has to speak in a group, he worries so about what he's going to say that he is less clear than if he spoke right off the bat.	——	——	——	—, 104+
65. This person feels sure that although he has faults, he is still a pretty likeable person.	——	——	——	+, 69—
66. This person sometimes feels that he has a hard time making up his mind whether to stick by his own standards or to act by the example of his friends.	——	——	——	—, 73+
67. This person does not feel that anyone says unfriendly things about him behind his back.	——	——	——	+, 2—
68. When he feels that he has made a bad impression, this person usually is afraid that he will not be able to set right the opinion the other person has of him.	——	——	——	—, 1+
69. This person worries himself sick over his faults and drawbacks.	——	——	——	—, 65+
70. This person feels that he sometimes finds it hard to own up to himself that he has been in the wrong: he feels that he must try to put the blame on something or someone.	——	——	——	—, 42+
71. This person tries to understand some of his feelings that he doesn't like, and he does not worry himself sick about them.	——	——	——	+, 7—
72. This person usually does not feel lonely when he is among people his own age.	——	——	——	+, 55—
73. This person usually can decide whether to stick by his own standards or to act by the example of his friends.	——	——	——	+, 66—
74. This person usually enjoys doing things for his own benefit.	——	——	——	+, 6—
75. This person feels that he finds it hard to keep from being bossed by some people.	——	——	——	—, 54+
76. This person sometimes feels that he is mixed up about the kind of life he wants for himself.	——	——	——	—, 8+

TABLE 1 (*continued*)

	That's like me (1)	That's not like me (2)	? (3)	Key
77. This person feels confident that he will make something worth while of himself.	____	____	____	+, 9—
78. This person feels that people like him for himsef, just as he is, with his good points and weak points.	____	____	____	+, 29—
79. If he cannot beat the odds against him, this person usually feels that he has done what he could and does not blame himself.	____	____	____	+, 17—
80. This person usually thinks of himself as a pretty worth-while person, even if some people do not think that way of him.	____	____	____	+, 12—
81. This person usually feels that people are happy to have him in their company.	____	____	____	+, 62—
82. This person feels that often he cannot make up his mind even about very simple things.	____	____	____	—, 46+
83. This person feels good about himself because of his many worth-while qualities.	____	____	____	+, 33—
84. This person seldom finds that he has to apologize to people for having offended them, although he has not meant to offend them.	____	____	____	+, 48—
85. Often when this person is tired, and wants to rest a while, he has a feeling that he can't afford to take it easy.	____	____	____	—, 31+
86. This person likes to try new things; he usually feels that he is pretty likely to succeed.	____	____	____	+, 4—
87. This person lives up to his own ideals, even when he feels that his friends may slight him for it.	____	____	____	+, 16—
88. This person feels that the kind of person he would like to be is very different from the way he actually is at present.	____	____	____	—, 28+
89. When things happen to go just right for him, this person never feels that he is going to pay for it; he feels that he deserves the good luck.	____	____	____	+, 44—
90. This person usually is sorry that he has made certain mistakes, but the memory of them does not bother him for long.	____	____	____	+, 34—
91. This person feels that he does not come down in the eyes of people if he asks for suggestions when he is mixed up about a problem.	____	____	____	+, 61—
92. This person feels that he has what it takes to be respected and that people respect him.	____	____	____	+, 39—
93. This person usually feels that in most things he is as good as his friends.	____	____	____	+, 19—
94. Even when he can't be sure of the way something will turn out, this person usually likes to make the decision himself.	____	____	____	+, 26—
95. This person feels glad he is alive.	____	____	____	+, 130—

TABLE 1 (*continued*)

	That's like me (1)	That's not like me (2)	? (3)	Key
96. This person feels that in most things, people give him a fair deal.	——	——	——	+, 30—
97. Sometimes this person feels that he does not deserve or have the right to fun or recreation.	——	——	——	—, 14+
98. This person usually does not feel that people show him friendliness just because they want to use him.	——	——	——	+, 27—
99. This person feels no guilt about things that don't bother most other people either.	——	——	——	+, 32—
100. If people do not tell him that his ideas are worth while, this person feels that his ideas probably are not much good.	——	——	——	—, 3+
101. This person often has the feeling that he is pretty much of a "phoney."	——	——	——	—, 15+
102. When this person gives help to anyone, he sometimes wonders whether he did it just to help the other person or maybe also to bring out his weak points.	——	——	——	—, 43+
103. This person sometimes feels that some of his friends have more to look forward to in life than he has.	——	——	——	—, 60+
104. When this person speaks in a group, he usually feels at ease and says what he wants to say clearly.	——	——	——	+, 64—
105. When this person has failed at some job or project, he is upset at first, but he does not keep on being broken up about it for very long.	——	——	——	+, 59—
106. This person usually feels that if people knew him well, they would know that he was not putting on a false front, that he was not just bluffing.	——	——	——	+, 21—
107. It often seems to this person that some people like to say things just to hurt his feelings.	——	——	——	—, 63+
108. This person feels that he is not a good mixer.	——	——	——	—, 50+
109. This person feels that he has to justify himself with some people to make sure that they will not "get him wrong."	——	——	——	—, 57+
110. If people criticize his actions, this person feels all broken up about it, even though he has acted by his own principles.	——	——	——	—, 56+
111. This person often is annoyed with himself because he feels that he is not able to control certain habits that he does not like.	——	——	——	—, 58+
112. When things are not going right, this person usually does not feel like quitting and keeps right on trying.	——	——	——	+, 49—

TABLE 1 (*continued*)

	That's like me (1)	That's not like me (2)	? (3)	Key
113. When he is with people, this person doesn't like to say anything; he feels that they would jump on his weak points.	___	___	___	—, 40+
114. This person does not feel that there is anything wrong or odd about him.	___	___	___	+, 24—
115. This person often feels that he's all mixed up about himself.	___	___	___	—, 11+
116. This person feels that his own ideas don't seem as keen or as smart as the ideas of other people.	___	___	___	—, 35+
117. When bad things happen to this person he often feels that he had it coming to him.	___	___	___	—, 51+
118. This person often sees in himself the kind of faults that his parents have said he has.	___	___	___	—, 41+
119. When some people criticize him, this person usually tries to understand the criticism and does not blame himself for it.	___	___	___	+, 36—
120. Sometimes this person has the feeling that he may never have anyone's love.	___	___	___	—, 5+
121. This person feels that he usually acts just like himself.	___	___	___	+, 37—
122. This person usually tries to understand his mixed up feelings of love and hate toward certain persons, and he does not blame himself for these feelings.	___	___	___	+, 13—
123. This person feels that there are difficulties in his life, but he usually is confident that he will overcome them if he keeps trying.	___	___	___	+, 45—
124. When some people praise him, this person often has the feeling that they are not sincere.	___	___	___	—, 22+
125. When this person meets anyone, he never feels that he must notice whether he is above or below the other person in this or that trait or quality.	___	___	___	+, 10—
126. This person sometimes finds it hard to live up to his own ideals because he is afraid that if he did, his friends would have little to do with him.	___	___	___	—, 18+
127. This person has the feeling that he can't relax or be at ease with other people.	___	___	___	—, 23+
128. In the midst of a job or project, this person often feels that he just is not able to see it through.	___	___	___	—, 20+
129. This person often feels that some people are annoyed by just having him around.	___	___	___	—, 53+
130. This person sometimes feels that it would have been better if he had never been born.	___	___	___	—, 95+
131.This person usually feels that most people respect him.	___	___	___	+, 25—
132. This person sometimes feels that he runs down his good points.	___	___	___	—, 47+

In other words, if a person responded to Item 1 (phrased in positive terms to represent self-acceptance) by placing a check mark in Column 1 his answer was regarded as "self-acceptance"; if he checked Column 2 his answer was "self-rejection"; if he checked in Columns 1 and 3 his answer was "qualified self-acceptance," and Columns 2 and 3 represented "qualified self-rejection."

It took the subjects from 20 to 35 or 40 minutes to respond to the 132 items.

a. Method of Scoring. As indicated above, the items were so phrased and the options for checking the items were so arranged that the response to each item could be assigned to one of four qualitative categories, as follows: "self-rejection"; "qualified self-rejection"; "qualified self-acceptance"; self-acceptance." Weights were calculated for these response-choices on the basis of the assumption that they were normally distributed in the population. As a result of statistical computation the weights assigned were: "self-rejection"—a value of six; "qualified self-rejection"—a value of four; "qualified self-acceptance—a value of three; and "self-acceptance"—a value of zero. The sum of the score values for all the items constituted the total ("self-rejecting") score. The higher the score, the greater the self-rejection.

3. *Clusters of Items*

In keeping with categorizations suggested in the literature the 132 items constituting the response-form were tentatively grouped under 13 headings. Each of these groups seemed to the investigator to represent a category of self-evaluation that was somewhat distinct from each of the others. These are the categories:

1. Own attitudes toward the self dependent on attitudes from others.
2. Inability to rely on own standards as a guide to behavior.
3. Feelings of not being respected by others.
4. Feelings of rejection by others.
5. Hostility of others toward self.
6. Feelings of inequality with others.
7. Feelings of inequality in social situations.
8. Unworthiness of the self.
9. Self-disparagement.
10. Self-condemnation.
11. Self-distrust.
12. Feelings of disorganization.
13. Inadequacy of the self regarding outlook for the future.

Comparisons were made between five independent judges (including the investigator) who undertook to group the items in terms of these categories.

The judges were instructed to leave items unassigned if they did not seem to belong to any of the 13 categories. For purposes of this study the idea was to find whether a considerable number of items should be grouped into logically or psychologically differentiated clusters. If such clusters could be identified it would then be possible to find statistically to what extent various clusters were differentiated.

If a considerable number of items could be demonstrated to belong, to a statistically reliable degree, to one logically or psychologically differentiated cluster rather than to another, it would tend to show that self-acceptance–self-rejection may, in different persons, appear in different sets of ideas, facets, or evaluations of the self.

It was decided to assign an item to a given category if at least three of the five judges agreed in placing it there.

On the basis of these criteria, 103 of the 132 items were assigned to the 13 categories: 53 items received unanimous assignments; four judges agreed in the placement of 31 items; only three judges agreed in the placement of 19 additional items. Fourteen items did not receive the minimum of three agreements, and were not included in the categories, and 15 items that had been used in illustrating and defining the meanings of the categories when instructions were given to the judges were also excluded from this set of groupings.

4. *Rating Scales Used by Teachers*

Four teacher rating scales were developed, raising the following questions:

1. How well does the student stand up under criticism?
2. How much confidence does the student show in his ideas?
3. How secure is the student in his social behavior?
4. How successful is the student in his relationships with his classmates?

Each of the questions was elaborated in some detail in order to help the teachers make their ratings as objective as possible.

The teachers were asked to rate the students positionally by writing the names of the seven (or, approximately a fifth of the class) who seemed to rank highest in each of these particular aspects of behavior and the names of the seven who seemed to them to rank lowest. Each scale was presented on a separate sheet. The teachers were asked to try to use each scale independently without regard to ratings assigned to students on the other scales. Ratings were received for six classroom groups.

C. Statistical Procedures and Results

Does the response-form have adequate statistical coherence? The answer to this question was sought as follows: Total scores were calculated for an experimental group of 277 subjects. The booklets were arranged in order from highest to lowest scores. The booklets representing the highest 27 per cent of the scores and the lowest 27 per cent of the scores were removed. The proportions of "self-rejecting" responses for each item were determined for the upper 27 per cent and for the lower 27 per cent. The correlation value for these two proportions was then obtained in the Table prepared by Flanagan on the Values of the Product-Moment Coefficient of Correlation in a Normal Bivariate Population.

1. *Reliability of the Response-Form*

The data in Table 2 give an indication of the statistical coherence of the response-form by showing that the great majority of the items differentiate to a statistically reliable degree between the extremes of the distribution of total scores.

Table 3 shows that the self-*r* of the response-form (i.e., the coefficient of correlation between the equivalent halves) is highly satisfactory for all groups of subjects. The reliability coefficients range above .90.

TABLE 2
INTERNAL CONSISTENCY OF THE RESPONSE-FORM
Correlation coefficients between items and total score estimated by Flanagan's procedure from upper and lower 27 per cent of the group ($N = 277$).

r	Frequency	*r*	Frequency
.00-.045	1	.40-.445	8
.05-.095	3	.45-.495	25
.10-.145	1	.50-.545	18
.15-.195	2	.55-.595	16
.20-.245	3	.60-.645	13
.25-.295	5	.65-.695	15
.30-.345	5	.70-.745	8
.35-.395	4	.75-.795	5

TABLE 3
MEAN SCORES, RANGE, AND VARIABILITY OF SCORES ON THE TOTAL RESPONSE-FORM, AND SPLIT-HALF RELIABILITY COEFFICIENTS (CORRECTED)

Subjects						
Sex	Mean age	*N*	Range	Mean	*SD*	Reliability
Boys	17.28	277	16-619	230.07	127.91	.96
Boys	14.34	97	73-572	260.16	98.34	.95
Girls*	16.97	196	48-628			
Girls	14.50	113	72-588			

*The computations for the girls were not completed.

Table 3 indicates that the scores are widely distributed and satisfactory for measuring group differences. The distributions are not perfectly symmetrical, however, the mean in every case being closer to the lower scores. (Whether this skewness indicates a statistically significant difference from normality has not been determined.)

2. *Relationships between the Clusters of Items*

To demonstrate statistically the relationship among the 13 clusters, as determined by five independent judges, it was necessary to obtain (*a*) the reliability of each cluster and (*b*) the intercorrelations among the 13 clusters.

Kuder-Richardson Formula 20 was applied in order to estimate the internal consistency of each cluster. Since the response-form as a whole, or in its parts, is intended primarily as a technique for the study of groups of individuals, coefficients of .50 or higher were regarded as adequate indicators of the internal consistency of the clusters. For differentiating groups of individuals, the error elements will tend to cancel out, even with coefficients as low as .50.

TABLE 4

Composition of four of the 13 clusters. Items, Item Reliabilities, and Extent of Agreement among the five judges in placing items in the given cluster.

Cluster 1. One's own attitudes toward the self dependent on attitudes shown toward one by others (6 items)									
Item No.	12	36	80	100	118	119			
Item *r*	.335	.33	.67	.755	.41	.47			
No. of judges agreeing in placement of item	5	5	4	4	3	3			
Cluster 2. Inability to rely on own standards as a guide to behavior (8 items)									
Item No.	16	18	56	66	73	87	110	126	
Item *r*	.535	.51	.495	.515	.55	.675	.615	.54	
No. of judges agreeing	5	5	5	4	5	5	4	4	
Cluster 3. Feeling of not being respected by others (5 items)									
Intem No.	21	25	39	92	131				
Item *r*	.65	.275	.66	.695	.73				
No. of judges agreeing	4	5	5	5	5				
Cluster 4. Feeling of being rejected by others (9 items)									
Item No.	5	53	57	62	78	81	109	120	129
Item *r*	.35	.695	.46	.60	.62	.765	.625	.60	.66
No. of judges agreeing	4	5	3	4	3	3	4	4	4

On a judgmental basis, most of the items of the response-form seem to be classifiable into meaningful clusters. Table 4 illustrates the findings obtained in connection with four of the clusters.

A matrix of intercorrelations was computed for the 13 clusters. Since

TABLE 5

Cluster Statistics: Intercorrelations, Internal Consistencies, Means, and Standard Deviation ($N = 277$)

Cluster	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	Tot.*
I		.422	.409	.491	.400	.518	.336	.466	.501	.444	.500	.414	.398	.630
II			.433	.510	.470	.443	.370	.310	.502	.407—	.593	.368	.393	.644
III				.717	.609	.551	.501	.371	.633	.404	.544	.475	.511	.733
IV					.699	.591	.627	.411	.703	.504	.604	.551	.562	.832
V						.535	.491	.401	.599	.437	.545	.514	.486	.751
VI							.497	.383	.535	.473	.557	.465	.511	.713
VII								.281	.523	.437	.569	.502	.453	.713
VIII									.456	.412	.362	.446	.363	.561
IX										.507	.625	.588	.570	.807
X											.497	.515	.429	.709
XI												.513	.509	.787
XII													.488	.711
XIII														.642
No. of items	6	8	5	9	10	6	9	5	13	12	11	5	4	
Mean	1.79	1.70	1.95	2.34	2.37	1.71	2.99	1.25	2.88	4.34	2.61	1.78	.69	
SD	1.38	1.95	1.28	2.17	2.32	1.41	2.70	1.29	2.47	2.95	2.65	1.46	1.06	
r_{tt}**	.398	.718	.542	.689	.723	.456	.795	.575	.62	.774	.766	.755	.494	

*Correlation of cluster with total score on response-form.

**Internal consistency of each cluster according to Kuder-Richardson Formula 20.

the clusters are assumed to have the same sub-stratum of "self-acceptance–self-rejection" it was thought that a good many of the correlations would not be near zero; it was also expected that some of the clusters might show close relationships.

It was thought that if the coefficients of internal consistency were satisfactory and the coefficients of correlation between one cluster and the other clusters were found to be much lower than the maximum permitted by the coefficients of internal consistency, this could be taken as statistical evidence for a certain amount of uniqueness of that cluster as distinguished from the other clusters.

It was the opinion of the investigator that a more rigorous method for determining the degree of uniqueness for each cluster, in relation to all the other clusters, was not essential for the purpose of the present study, which is not to provide independent measures in the form of clusters of items, but which is, rather to determine the kind of statistical relationship, differential or not, that exists among the logically or psychologically postulated components for the group of subjects studied.

Within the purposes of this study, there is statistical evidence for satisfactory internal consistency of at least 10 of the 13 clusters as shown in Table 5. These 10 clusters have coefficients ranging from .541 to .795. The coefficient for Cluster XIII is .4937, or pretty close to .50, and may be accepted with reservation; the coefficient for Cluster VI is .456; the coefficient for Cluster I is .3985, making this the least reliable of all.

The intercorrelations, in relation to the reliabilities, indicate varying degrees of statistical differentiation among the clusters. Some of the coefficients are low enough to indicate reliably a substantial amount of uniqueness for the given clusters in relation to each other, as for example: For Clusters II and VIII, with reliability coefficients of .718 and .575, respectively, the coefficient of correlation is .37. The clusters are "Inability to rely on own standards as a guide to behavior" and "Unworthiness of the self." For Clusters VII and VIII, with reliability coefficients of .795 and .575, respectively, the coefficient of correlation is .281. The clusters are "Feelings of inequality in social situations" and "Unworthiness of the self."

Some clusters seem to show substantial independence from many of the other clusters, as for example, Clusters II and VIII, "Inability to rely on own standards as a guide to behavior" and "Unworthiness of the self," respectively. Cluster II, with a reliability coefficient of .575 has four coefficients of correlation in the .30's, five in the .40's, and three in the .50's.

Cluster VIII with a reliability coefficient of .575, has correlation coefficients ranging from .281 to .466.

Some of the clusters seem to show close relationship. Clusters IV and V with reliability coefficients of .689 and .723, respectively, have a coefficient of correlation of .689. These clusters are "Feeling of being rejected by others" and "Expectance of attitudes of hostility from others toward self." Clusters III and IV, with reliability coefficients of .54 and .689, respectively, have a coefficient of correlation of .717. These clusters are "Feeling of not being respected by others" and "Feeling of being rejected by others." Clusters III and V, represented in the two preceding examples, have a coefficient of correlation of .609.

If the purpose of the present study were to provide independent measures, Clusters III, IV, and V might perhaps reasonably be combined since they correlate highly, particularly in view of their very satisfactory internal consistencies. But the purpose of the statistical analysis of clusters was to have an indication of the kind of statistical relationship that exists among the several logically or psychologically postulated components, for the group of subjects studied.[3] It would also be worth while to explore relationships of the qualitative nature of the clusters but this exploration has not been undertaken.

The correlation coefficient of each cluster with the total score is in every case larger than the correlation of each cluster with every other cluster.

3. *Other Results*

a. Age averages. The results were computed for two groups of boys differing in age. One group consisting of 277 boys with an average age of 17.28 showed an average score of 230.07. A younger group consisting of 97 boys with an average age of 14.34 showed an average score ot 260.16. In other words, there was a difference of about 30 points between the two averages. The ratio of the difference between the means to the standard error of the mean difference is 2.388 indicating a larger difference than might be expected by chance. The older group of boys tended to be more variable than the younger group. Reasons for the higher self-rejection score among the younger boys have not been explored. Differences between groups of girls had not been computed at the time this report was written.

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[3] As the writer sees it, at this point, the fact that some groups of clusters show a high degree of relationship while other clusters show substantial independence, for the group of subjects studied, indicates that "self-acceptance—self-rejection" tends to appear differently when approached in different ways and suggests the possibility that with other groups of subjects, the grouping of clusters might appear in different patterns or the clusters might show greater independence.

b. Academic achievement in relation to attitudes toward self. In computations based on results obtained for 277 of the young people it was found that the correlation between academic achievement and scores on each of the 13 clusters and on the instrument as a whole were practically zero. The coefficients of correlations ranged from .013 to .099.

c. Teachers' ratings. The relationship between teachers' ratings and scores on the response-form varied according to the basis of the rating. Twenty-seven students were named when teachers were asked to rate the seven students in each of the several classes that stood highest on the criterion "How well does the student stand up under criticism?" and 26 students were named as standing among the lowest. The respective means of the high and low groups were 199.6 and 275.5. The ratio of the difference to the standard error of the difference was 2.10. This finding indicates that students who, according to teachers, suffer the greatest loss of morale when criticized by others, also show a distinct tendency toward self-rejection when judging themselves.

Small and quite unreliable differences appeared when those who rated high and those who rated low on "How secure is the student in his social behavior?" were compared with respect to self-acceptance–self-rejection scores.

When rated with respect to "How successful is the student in his relations with his classmates?" the respective means of the high and low groups were 220.7 and 263.5. The ratio of the difference to the standard error of the difference was 1.40.

D. SUMMARY

This report deals with the content and statistical reliability of an instrument for the appraisal of certain aspects of self-acceptance–self-rejection. The instrument is a self-rating device consisting of a 132-item form by means of which the respondent can reveal how he consciously evaluates himself or claims to view himself.

The instrument was administered to several hundred high school students. The findings indicate that the instrument seems to provide a substantially reliable and effective means of getting information concerning some of the ways in which a person views himself or professes to think that he views himself.

When self-ratings on the response-form were compared with four ratings assigned by teachers two of the four comparisons showed no relationships while two of them indicated that students who are most affected by criticism from others and who seem to be less successful in their relations with others also tend to have more negative attitudes toward themselves.

The study also reports internal consistencies and interrelationships that were found when items of the response-form were grouped in terms of 13 categories of self-appraisal. It appears that there are several categories of self-evaluation which, while interrelated, also show an appreciable degree of independence.

The instrument provides a basis for further study of relationships between the ways in which people view themselves or profess to view themselves and other factors such as circumstances in their lives at home or at school; the relationships between people's views of themselves and the ways they are viewed by others. In conjunction with other data, the instrument might also be used to study the relationship between the manifest or consciously recognized or professed ideas people have concerning themselves (as shown in the response-form) and latent or "unconscious" attitudes that influence their attitudes and conduct as observed in them or imputed to them by clinical psychologists or psychoanalysts.

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[4] The references in this list represent the ideas, published and unpublished at the time, which influenced Mrs. Spivack's work.

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A TEST OF THE MAGNETIC THEORY OF HOMING IN PIGEONS*

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A. INTRODUCTION

One of the most fascinating but still speculative of behavioral phenomena is the ability of various species of birds to return to their nests from great distances. This ability, called *homing*, is perhaps most familiar in pigeons. Homing pigeons, with proper training, are able to home to their lofts from distances up to several hundred miles, even over unfamiliar terrain. An equally mysterious phenomenon is the ability of some species of birds to migrate many thousands of miles. Thus, the *golden plover* is known to travel 2,000 miles from Alaska to Hawaii, all over water (5, 8). While homing and migration are sometimes treated separately (8), some authorities feel that the underlying mechanisms involved are essentially the same (1, 5).

In an attempt to explain these abilities, many theories have been propounded. Some, such as the "mysterious force" (e.g., extra-universal) or simple "instinct" theories we may reject on the basis of a priori tenets of science. Others deserve more careful study because they are amenable to experimental tests. Of the latter, one in particular has been the topic of much research and discussion in recent years. This is the magnetic-vertical-coriolis theory propounded by Yeagley (9, 10).

Yeagley's theory supposes that pigeons are able to home because of three essential factors: (*a*) sensitivity to the effect of flying through the earth's magnetic field, (*b*) sensitivity to the forces produced by the earth's rotation acting on masses moving over its surface in a straight line (coriolis effect), and (*c*) visual sensitivity to land speed. Yeagley asserts that by correlating these three factors, a bird is able to recognize its home locality at the intersection of "a characteristic line in the earth's magnetic vertical field with a characteristic line of latitude" (9, p. 1039).

Yeagley and his collaborators have done a good deal of research in the

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past several years in an attempt to test the validity of this theory. Their various experiments have been of a large-scale, statistical type; and many have provided suggestive but by no means conclusive results. The work of Gordon (3), on the other hand, appears to contradict Yeagley's results.

B. PROBLEM

The study described in this paper represents a laboratory attempt to test the basic tenet of the Yeagley theory—i.e., that pigeons are sensitive to the effect of passing through a magnetic field. Specifically, the experiment tests the effect of magnetic lines of force moving through stationary pigeons, but from the standpoint of the electromagnetic effect, it makes no difference whether a conductor cuts lines of force or vice versa. Moreover, Yeagley (9, p. 1040) has emphasized that his theory asserts that "the laws [of bird navigation] obeyed are the same or analogous to the electromagnetic effect."

The conditioning technique was employed entirely throughout the present experiment, with electric shock used as the *US*. The design, however, immediately raised several problems, the solution of which, incidentally, has provided some information of a more general interest to comparative psychology than was our original intent.

The first requirement was to establish a kind of norm or level of conditioning in pigeons when electric shock is the *US*. Since a search of the literature revealed no examples of electric shock having previously been employed with these animals, we undertook the conditioning of pigeons using the buzz-shock method (6). The results of this preliminary study, although satisfactory, showed a very slow rate of learning in reaching the criterion. As a consequence it was decided to use the same animals in later experiments, so as to profit by the positive transfer in learning that might be expected through stimulus substitution in already-conditioned birds. This decision, of course, raised the problem of how much transfer might be expected when buzz-shock conditioned pigeons are subjected to training with a second stimulus-shock sequence. Consequently, our second problem was to attempt to condition birds that had already been buzz-shock conditioned to a light-shock sequence. The last problem (which in reality was to have been the first problem) was to attempt to condition the same birds to a magnetic-field-shock sequence.

The experiment as a whole may be regarded as a study of the development of "learning set" in the traditional conditioning situation (4).

C. METHOD

1. *Subjects*

Two female pigeons, *Columbia livia (L)*, of the homing variety, both approximately 2-3 years of age were used throughout the entire experiment.

2. *Buzz-shock Conditioning*

The birds were placed in an 18 in. square lucite box or cage, the floor of which consisted of an electric grid constructed of parallel ⅛ in. brass rods spaced ½ in. apart. To insure constancy of the visual environment throughout all phases of the experiment, the lucite box was mounted in the center of the vertical solenoid to be used in the magnetic-field-shock sequence(*vide infra*). Grid current could be varied from 0-1,600 volts by means of a variac. Voltages were obtained from a step-up transformer energized by 60-cycle alternating current.

An ordinary door-bell buzzer placed about two feet from the subject was the *CS*. The timing and duration of both *CS* and *US* were controlled by an automatic timer. Length of buzz was 2.00 sec., the last .11 sec. overlapping with shock. Time between trials was varied randomly from 32 to 92 seconds. Shock was omitted on approximately every fifth trial.

The birds were allowed two daily habituating periods of 20 minutes each in the lucite cage before any conditioning was attempted. Thereafter each subject was given 20 trials per day of the buzz-shock sequence until the conditioned behavior reached a criterion of 19 *CR*'s/20 trials, or 95 per cent. During each daily session the shock voltage was adjusted, whenever necessary, so as to maintain an approximate uniformity in the magnitude of the *UR*. The grid was cleaned daily and the birds' feet were washed and then allowed to dry for 15 minutes before each session. Wings were clipped in order to prevent the *S*'s from avoiding the grid by flying above it.

The successive daily sessions were conducted in a sound-insulated room at approximately the same time each day. The experimenter was hidden from the animals by a one-way-vision screen. The automatic timing device and other apparatus which might emit threshold noises or unknown cues were housed in another room. Illumination was produced by a 100-watt bulb suspended four feet above the cage.

3. *Light-shock Conditioning*

The apparatus and procedure were the same as for buzz-shock conditioning, except that a 200-watt bulb suspended two feet over the cage was substituted for the buzzer. Illumination between trials was as before.

4. *Magnetic-field-shock Conditioning*

A solenoid 20 in. square and 54 in. long was constructed on a wooden frame. This was achieved by winding the frame with No. 16 Formvar magnet wire, five turns to the inch. The axis of the coil was vertical and the conditioning cage rested at its center. The solenoid thus extended 18 in. above and below the cage, so as to surround it with a uniform field. Neither solenoid nor cage contained any magnetic metals in their construction.

The magnetic field generated by the solenoid rose from 0 gauss in the same direction 120 times every second. This varying field was produced by passing 60-cycle alternating current through a full-wave frequency rectifier and a 1:1 transformer. The strength of the field was then kept constant during the training by means of a variac and ammeter in the solenoid circuit. The maximum intensity of the magnetic field was maintained between 4.5-5.5 gauss, which is approximately 25 times the intensity of the earth's field. The presence and strength of this stimulus were checked by a gaussmeter.

The magnetic field thus produced was substituted for the buzzer and light used previously. Timing and procedure were as before.

D. RESULTS

The *UR* which was elicited by the electric shock may be described as a rapid withdrawal from or avoidance of the grid, characterized by flapping of the wings and jumping. Its duration was less than one second. The experimenters were amazed to find that the strength of the *e.m.f.* necessary to produce a consistent response of this nature varied between 250 and 850 volts, generally falling in the region of 450 volts. These unusually high voltages (when compared with those required for similar responses in other organisms) are no doubt a function of the high electrical resistance of the scaly feet of the birds.[2]

During the course of the experiment three types of *CR*'s could be distinguished. These were: (*a*) side-to-side head movements, accompanied by stretching of the neck, which will be referred to hereafter as "peering";

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[2] Independent measures of the electrical resistance of the feet of one of the experimental birds yielded values that varied from 100-300 megohms. Hence the amount of current employed to motivate the birds was roughly 3 microamperes. While the voltage value was then much higher than that needed to motivate many other organisms, the current value was a good deal smaller. In terms of power, however, the value is several milliwatts, which is comparable to the power needed to motivate other animals. These findings may have some bearing on the current controversy over whether it is voltage, current, or power that is most relevant in motivating animals.

(*b*) walking, running, or stepping, which will subsequently be called "walking"; (*c*) lowering of the tail feathers until they touched the grid. The last response, which might or might not accompany the other two reactions, was highly inconsistent and variable. Consequently it is not considered in the quantitative treatment of data which follows. The peering *CR* was the most rapidly established, reaching the criterion of 95 per cent after 100-200 buzz-shock trials. But since this response frequently occurred between trials without apparent external stimulation, and since walking was a much more obvious and clear-cut reaction to the *CS*, it was decided that the trials be continued until conditioned walking was obtained 95 per cent of the time.

The number of trials required with each experimental sequence to obtain a criterion of 95 per cent conditioning for both the peering and walking responses are given in Tables 1 and 2. Figures 1 and 2 present Vincent curves (7) of the learning that took place under the three experimental conditions for both types of *CR*'s for the two subjects combined. These results show clearly that no apparent learning took place during the magnetic field-shock training trials.

TABLE 1
NUMBER OF TRIALS FOR SUBJECTS TO REACH CRITERION FOR PEERING RESPONSE UNDER THREE EXPERIMENTAL CONDITIONS

Experimental condition	Trials		Criterion reached	
	Bird *A*	Bird *B*	Bird *A*	Bird *B*
Buzz-shock	120	180	100%	100%
Light-shock	40	60	100%	100%
Magnetic-shock	1,000	860	——	——

TABLE 2
NUMBER OF TRIALS FOR SUBJECTS TO REACH CRITERION FOR WALKING RESPONSE UNDER THREE EXPERIMENTAL CONDITIONS

Experimental condition	Trials		Criterion reached	
	Bird *A*	Bird *B*	Bird *A*	Bird *B*
Buzz-shock	820	820	95%	95%
Light-shock	180	260	95%	95%
Magnetic-shock	1,000	860	——	——

E. DISCUSSION

The reduction in learning time for light-shock conditioning is undoubtedly partially a result of positive transfer from the sound to the light stimulus. It may also be regarded as a case of higher order conditioning with constant motivation (2) or as the development of a learning set (4). However, the writers do not feel justified in assuming that the more rapid learning of the light-shock sequence is due wholly to these factors. The difference in sense modalities employed may also have exercised some effect, since it is likely that pigeons react more readily to visual than to auditory cues.

For the same reason it cannot be categorically assumed that the pigeons—even if sensitive to magnetic lines of force—would learn a magnetic-shock sequence more rapidly than they learned the buzz-shock sequence. On the

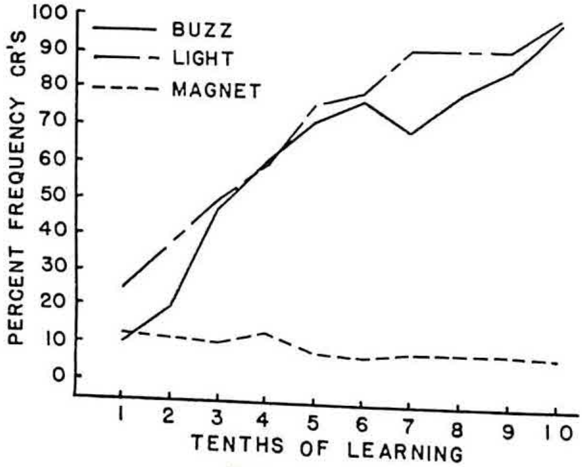

FIGURE 1

Vincent Curves of the Acquisition of Peering *CR*'s in Both *S*'s Under Three Experimental Conditions

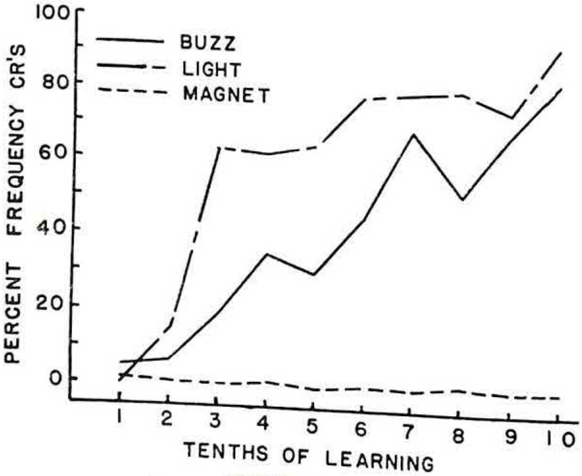

FIGURE 2

Vincent Curves of the Acquisition of Walking *CR*'s in Both *S*'s Under Three Experimental Conditions other hand, if they are capable of responding to a magnetic stimulus at all, it would certainly be supposed that they would show some evidence of learning in the experimental situation. Results indicate, however, that the birds were completely unable to build up an association in the magnetic-shock sequence of this experiment. There is not the slightest evidence even of the beginning of learning, although more magnetic-shock trials were given than in either of the other two sequences (see Figures 1 and 2).

The conditions of this experiment were circumscribed and narrow, however, and hence there are several reservations or qualifications regarding whatever conclusions may be drawn from the data. These apply both to the limited scope of the results and to any evaluation of the Yeagley theory which may arise from them.

A first and most obvious qualification is that the study employed only two subjects. The sample is therefore not representative and the results must be regarded as preliminary and suggestive rather than conclusive. However, we might qualify the qualification, so to speak, by pointing out that both birds were of the homing variety and had had previous, satisfactory training in homing to their lofts.

A second qualification is that the experimental design does not duplicate conditions as they are in nature, and, consequently, as they are treated in Yeagley's theory. While the magnetic stimulus used here passed through the intensity of the earth's magnetic field to a value of approximately 25 times the earth's field and did this 120 times per second, it may have presented these intensities too rapidly, too intermittently, or in some other way which might affect their reception.

A third qualification is the possibility that the electric shock may in some way have interfered with the pigeon's receptivity to a magnetic stimulus.

F. CONCLUSIONS

1. Pigeons can be conditioned by the buzz-shock method, although the progress in learning with this method is considerably slower than with some other organisms.

2. Shock of the order 250-850 volts is necessary to obtain a consistent unconditioned reaction of jumping or hopping.

3. Two major types of *CR* were elicited with this method: (*a*) "peering"—side to side movements of the head acompanied by neck stretching, and (*b*) "walking," which includes stepping or running.

4. Light-shock conditioning of the pigeons which had previously been buzz-shock conditioned took place in approximately ¼ the training time

needed to establish the original buzz-shock conditioning. This is partly a function of positive transfer from one learning situation to the next, and it may also be due in part to greater sensitivity to visual than to auditory stimuli.

5. When given 860 and 1,000 trials with a magnetic-shock sequence, the pigeons, although previously buzz- and light-shock conditioned, showed no evidence of learning whatsoever. As indicated by the method used, this inability to learn would mean that they are insensitive to the magnetic stimulus employed.

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THE LEARNING OF RÔLES AND OF CONCEPTS AS TWIN PROCESSES*

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The phrase "system of rôles" signifies that no rôle stands by itself, but gets its characteristic definition from relationships with other rôles. Implicit in this phrasing of the matter is that when anyone learns about a rôle, he learns what associated rôle-players expect and permit of each other and what they, in turn, are obliged and allowed to do. Rules of the game, norms, govern these relationships—even when relationships are in flux, as to a certain extent they always are.

It follows that the central locus of research on the learning or acquiring of rôles must be on rôle relationships. This paper will deal with the classificatory character of rôle relationships and show several implications of this for studies of rôle learning. Data drawn from a study of children's learning of concepts and rôles will demonstrate the fruitfulness of the analysis in an area where, as Sarbin remarks in a review of rôle theory, "genetic accounts of rôle expectations . . . are virtually non-existent" (7).

Rôle-players participate in a network of relationships. Rôles interlock and intermesh. Viewed abstractly this network or system of rôles involves classes of persons (publishers, writers, readers, printers), classes of acts, classes of rights and privileges, and so on. Insofar as there is agreement among rôle-players on what classes of acts go with what classes of persons, there are smoothly functioning relationships among them. Insofar as there is misunderstanding as to what class of acts properly goes with what categories of persons, then rôle relationships are disturbed: as when a young interne new to a hospital insists upon acting as he conceives a doctor should act, thus taking away from a nurse certain tacitly held privileges that go with the rôle of nurse in this particular hospital setting.[1] Persons new to any rôle system must always learn, it is generally recognized by students of social organization, what are the real rôles, or informal organization, as over against the officially promulgated formal organization.

All this is tantamount to stating that a system of rôles can be viewed as a

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conceptual system, wherein the classes or concepts are defined in terms of various reciprocal relations. An example or two will help make this clear if it is not already so. Oranges and lemons are classes included within the class of citrates, which in turn are fruits: so that apples and oranges are related by definition. So far as action is concerned, both may be served in a fruit salad. Likewise nurses, doctors, and secretaries are classes who constitute part of the working staff of a hospital department, who are set apart from each other in certain defined ways, and in turn are linked together in certain other ways with regard to patients. The examples are trivial, but the point, made in books on logic, is that classes are related in classificatory systems: and rôles, rôle playing, and rôle relationships may be so viewed.

Current discussions of rôle learning tend to focus overmuch upon the face to face character of rôle playing, and tend to treat learning as a somewhat personal direct matter. The person learns the rôle by modeling his behavior after another, by being taught his place or his lesson by the counter rôle-player (son and mother), by means of reward and punishment, etc. The teaching may be intentional or indirect, but the learning situation is generally conceived as taking place in an interpersonal context. A great deal of rôle learning takes place, of course, in such situations. But to state the process in this way is to miss an important implication of what a rôle system constitutes. Many rôle relationships are extremely abstract—as for instance those that exist between Negro and white, or between wife and husband. The relationships are made manifest through concrete, visible acts; but their abstractness and often their impersonality are made clear when one tries to explain them to children, or when representatives of these classes of persons plead before courts of law. To place so much reliance upon direct interpersonal learning of rôles both underestimates the conceptual character of rôles and understresses the interpretative character of direct perception. Even those rôle relationships that seem most concrete and visible, as say that between a teacher and pupil, are like icebergs in that much of their meaning simply is not visible to the youngster, and only gradually will he discover the fuller extent of this set of relationships. We are underscoring, and perhaps overstressing, the remark of Newcomb (following the writing of G. Mead) that the process of rôle learning is greatly facilitated by the development of language (4, p. 307). Studies of rôle learning, we are suggesting, ought to take this conceptual aspect of rôle-playing into full focus.

Conceptual learning occurs at every age past the pre-lingual months. The conceptual systems of young children are deficient from the standpoint of adults in knowledge and usually in terms of logic. However childish they may appear, the child's conception of relationships between persons, things, and acts, are nonetheless conceptions. A model for conceptual learning was presented in a series of earlier papers that deal with children's conceptualizations of monetary relations. The gist of the model is that, in children, the content of concepts undergoes continuous change.

> Hypothetically one could imagine that while formation of a given concept, *X*, might be prerequisite to others, formation of the latter might leave concept *X* unchanged. This does not happen for there is a propulsive and interactive character to naming and renaming. As new classifications are formed, the meanings of old ones change, become revised and qualified, so that little remains of the initial or early meanings of concepts (9, p. 285).

As conceptualizations approach the adult ones, they become more like the latter in scope and completeness and become from the adult's point of view more knowledgeable and less erroneous. This implies that the child's initial grasping of rôle relationships not only is deficient, but is deficient in ways not necessarily accidental. If his conceptualization is erroneous, it nevertheless has its own organization.

Hartley and his associates (2, pp. 387-98), in an interesting exploratory paper a few years ago, suggested that there might be some developmental logic connected with what rôles seemed to the young child to be compatible and incompatible. Children were asked questions like "Can you be both Jewish and American at the same time?" and "Is this father still a father when he is a mailman? Is this mailman still a mailman when he is a father at home?" Hartley hypothesized very tentatively that there tends with increase in age to be a progression through four stages (2, p. 390): (*a*) The individual is perceived as identical with and limited to the single rôle in which he is momentarily observed (*A* or *B*). (*b*) The individual is perceived as having at least one continuing rôle plus a number of momentarily occupied rôles (always *A*, sometimes *B*). (*c*) The individual is perceived as consisting of all the rôles he occupies (always *A* and *B*). (*d*) There is selectivity. An individual is perceived as functioning in a permanent or momentarily defined rôle but retains the potentiality for being other things (*A* with *B* potential). In this paper no explanation is offered for the progression of stages. In more recent writing (1, p. 527), Hartley has suggested that the child's general confusion over multiple rôles may stem partly from limited experience with rôles and partly from intellectual limitations. Apropos of the latter, he notes an early study of Piaget that demonstrated inadequate concepts of citizenship, country, and region—which in turn led children to deny that one could be either Swiss or Genevan, but not both (5).

In some materials dealing with children's learning of monetary concepts we have discerned something of the same kind of denial of the compatibility of rôles. There appears to be a fairly regular progression of rôle compatibilities, and this progression becomes clarified if one thinks of rôle relationships as conceptual relationships.

This, in turn, will point up one of the unexplained points in Hartley's discussion: because although a young child may not be able to conceive of his mother as a saleswoman, he can nevertheless conceive of her as a daughter of his grandmother. This he can do because in his immature conceptualization of rôles, certain ones are conceived as related and others are not. The point can be illustrated anecdotally first with an example drawn from conversation with a child of five. The child knew that I had no brother. He also knew that I was not a relative of his. His conception of "brothers" was that two males went together; and, further, that anyone could have another male as a brother if the latter would consent. I said that I would like his father to become my brother, and the child having sounded out his father and received an agreeable affirmative, announced that I now had a brother. He agreed, too, with understanding, that I was his uncle. However, further conversation revealed that his father already had another brother and did not need me, hence I was not his brother. Brother is not necessarily a reciprocal relation. In the child's thinking there was a very curious inclusion and exclusion of rôles, but this is perfectly understandable in terms of his level of conceptualization.

Our investigation of monetary concepts had not only to do with money, but with the various rôles implicated in buying and selling: storekeepers, customers, owners, helpers, manufacturers, and middlemen. Using a method described in previous papers, stages of concept development were discovered and described for children ranging from four and a half to eleven and a half years old (9). Here are two illustrations involving such rôles. At Stage I (median 5.4 years): "Both storekeeper and customer handle money during . . . transaction. In fact they pay each other. . . . Only the customer buys goods, the storekeeper never does." Stage II (median 6.5 years): "Not only is there a maker [of goods], but most of the children understand that the storekeeper must pay him, otherwise he does not get the goods. Some children realize that when the storekeeper buys he is simultaneously storekeeper and customer, although how two rôles can be played simultaneously remains unverbalized" (9, p. 277-9).

A more exact treatment of some of the rôle compatibilities and incompatibilities that appear per stage will now be suggested. The résumé will be kept brief, since the main purpose is not to outline precise sequence, but to show how sequence is but the obverse side of concept development. More exact outlining of sequence of rôle conception ought to rest upon a specific study designed for this purpose.

At an early step in his concept development, the child will deny that two rôles are compatible because each appears to him to belong to a different world. (This is akin to the examples given by Hartley.) Can a teacher be a storekeeper? "Oh no, she's a teacher." "No, that would be silly." Presumably, too, teacher and storekeeper are essences rather than activities, because it does not occur to the child as it does at the next stage that a teacher can become a storekeeper after school hours, or that the storekeeper can turn into a teacher after he leaves his store. But when the child admits this, then he admits it at first only for those discrepant rôles which belong to different worlds. He denies that storekeepers and customers (who after all constitute mirror rôles) can be interchangeable. The storekeeper, even though he is conceived as buying in other storekeepers' stores, is not thought of as a customer and is denied that status.

The next step that seems to be taken is that the customer, the storekeeper, and the manufacturer (who now comes into the picture) are viewed as bundles of activity rather than merely as kinds of persons. Hence, they may become transformed into each other at successive moments in time. This interchangeability is at a much higher level of abstraction than admitting that the teacher and storekeeper can become each other after regular working hours. The child now also makes certain rôles simultaneous as well as successive, because he sees the three rôles in a broader framework. A storekeeper who buys from the manufacturer is simultaneously both a storekeeper and a customer. A manufacturer who purchases from a storekeeper is simultaneously both a manufacturer and a customer. At the next stage a further step is taken, when the storekeeper is seen simply as a customer when buying from anyone, including from the manufacturer. Now there is a simultaneity of minor rôles somewhat more sophisticated than when a storekeeper had also to be a customer while purchasing.

Next appears a firm understanding that rôles not only may be successive and simultaneous when complimentary, but that rôles actually involve duality or multiplicity. Thus the owner of a store involves being an employer of workers, a customer of manufacturers, and a storekeeper if he chooses to be one. Likewise, the storekeeper is necessarily a worker in the store and a customer of the manufacturer. Implicit in this recognition of multiplicity is a vastly improved conceptualization of "customer"—who now is clearly conceived as including many other classes of persons besides the visually apparent persons who buy in stores.

The ways in which rôles are viewed as contradictory, and hence forbidden, or congruent and so permitted, continue even then to be dependent upon the child's level of conceptualization. Two or three more examples will be given. At the time that the idea of impersonal arithmetic relations is thoroughly grasped, the child can see why it makes no difference whether the storekeeper gives the goods before receiving payment or whether the customer pays first. But for a very long time after (a year or two), the children refuse to allow the customer the right to take the goods home, and not pay until a day or more later. They do not get the idea that sales transactions are genuinely logical in character rather than merely temporal, and so they do not understand the matter of delayed payment or credit. Likewise, up until the age of nine years or so, our young subjects denied the possibility that a storekeeper might also simultaneously be a cheat (i.e., cheating deliberately by making errors in returning change): because this simultaneity depends upon an extremely complex conception of monetary arrangements. One final example is provided by our most advanced subjects who, at the age of 11, still did not understand about middlemen. It made no sense to them to have a customer who both bought and sold in the function of a mediator or middleman. This rôle apparently involves an understanding of a more complex set of spatial, temporal, and logical relationships than any preceding rôle conception.

Summary and Discussion

It was pointed out that system of rôles can be thought of as classificatory systems. Such systems are learned only partly in face to face or direct learning situations, since conceptual relationships have an abstract character. Children's perceptions of rôle compatibility and incompatibility are shown to be directly connected with level of conceptual development. There appears to be a fairly regular progression of such rôle conceptions. The more that the child's conceptualization in general approaches that of the adult, the more extensive are the connections among his classifications; and the more complex, generalized, and abstract therefore is his systematization of rôle relationships. The ability to take the rôles of multiple and organized others in rôle relationships is closely dependent upon linguistic or conceptual learning.

This general theoretical point obviously is applicable to studies in the growth of prejudice, of self and identity, or moral rules, and the like. Apropos of moral rules, it has been shown elsewhere (10) that Piaget's explanation for the well known direction of moral development—from concrete and absolutistic notions to abstract and generalized ones—is suspect because the phenomenon of conceptual development was not taken into account. There is no need to explain moral development by special kinds of social conditions as Piaget did, nor by oversimplified principles like reward and punishment or by generalization from specific to wider situations. Conceptions of rôles and of rules grow pari passu, and involved in both are conceptual distinctions. These are all determinable and can be studied.

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SOME MATHEMATICAL AND LOGICAL CONCEPTS IN CHILDREN*

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A. Problem and Procedure

In a recent publication (2), Jean Piaget describes some "experiments" which, he says, reveal how children form "mathematical and logical concepts" and at what age these concepts are formed. He states that there are definite stages in the development of these concepts.

Deutsche (1) has summarized many subsequent investigations of the theories propounded by Piaget concerning children's concepts of causal relations in natural phenomena. Although Piaget had found clear-cut differences between adult and child explanations of causality, and various stages in the development of causal thinking, most of the later investigations have failed to find these differences and stages. Deutsche says: "Most of the evidence suggests that degree of difficulty determines the kind of response" (1, p. 13). And further: "Piaget's classification of causal thinking into seventeen types appears to be no longer useful. . . . No evidence was found that children's reasoning develops by stages" (1, p. 99).

The present study was designed to determine whether Piaget's results from his more recent explorations in the formation of mathematical and logical concepts in children could be confirmed by using some of the same problems with children in this country.

The subjects (*S*s) were 14 four-year-old children, 20 five-year-olds, and 18 six-year-olds; a total of 52 children. Thirty-one children were of the middle socio-economic group; 21 from the lower socio-economic group according to the Warner-Meeker-Eells Index of Status Characteristics (3). The low economic group of five- and six-year-olds was used as a check against possible bias.

Four of Piaget's problems were presented to these *S*s:

1. The *S*s were asked to count 10 small green blocks arranged (*a*) in a straight line, (*b*) in a pattern, as $\begin{array}{c} x \\ x\;x \\ x\;xx\;x \\ x\;x \\ x \end{array}$ (*c*) piled up loosely by the investigator.

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2. Eight white chips were placed on the table and the *S*s were asked to take an equivalent number from a box of red chips. The white chips were placed in three arrangements: (*a*) close together, (*b*) approximately two

x x
inches apart, (*c*) in a pattern, as x x x x.
x x

3. Two identical jars were presented and the *S* was asked to fill them by putting a red marble in one jar with one hand at the same time that he put a blue marble in the other with the other hand. After about three-fourths of each jar was filled, *S* was asked to compare the number of marbles in the two jars. *S* was then asked to pour the marbles from one of these jars into a jar of larger diameter, then compare the number of marbles in the two jars.

4. The investigator stuck two match sticks in modeling clay and (*a*) stood them up at each end of a long piece of cardboard. The *S*s were asked to form a straight line between them with more matches and clay. (*b*) Two matches were placed diagonally on the cardboard and the children were asked to form a straight line between them.

B. RESULTS

1. Piaget stated that children of five or six years have not grasped the idea of conservation of number so that with change of pattern they cannot count correctly.

In the present study, this result was not supported. If a child could count at all, he could count the blocks whether they were in a line, a pattern, or piled up. Seven of the 14 four-year-olds, 17 of the 20 five-year-olds, and all of the six-year-olds counted all three arrangements correctly.

2. Piaget had found that his *S*s of five years or younger ignored the spaces between the chips and believed that the "number is the same if the length of the row is the same" (2). If he spaced the row "loosely," the six-year-olds thought that the longer row had more chips. It was not until children reached about seven years that they really understood the concept of number, Piaget concluded.

No stages were found in the development of the number concept. Twelve of the 14 four-year-olds, 18 of the 20 five-year-olds, and all of the six-year-olds had the correct concept of number. The four children at four and five years who were unsuccessful in counting the chips were also unsuccessful on the blocks, the marbles, and the match sticks. However, they did not show the earlier stages described by Piaget. They just kept taking the chips out to play with them.

3. For Piaget, this problem is concerned with what he terms a logical concept—the conservation of quantity. He states that before seven years of age, if the number of marbles in one jar is higher than in the other, the child thinks that the number has changed.

This finding was not supported in the present study. When the children were asked: "Which jar now has more marbles?," they would indicate the smaller jar. "Does it really have more marbles?" The general reply was: "No. It looks like more. But I put the same in. It's 'cause this jar is taller (or thinner, or smaller, or narrower, etc.)." Those who gave this reply were 10 of the 14 four-year-olds, 15 of the 20 five-year-olds, and all of the six-year-olds. Those who did not give this response replied to the second question with "It's supposed to," "I put more in," "I don't know."

4. Piaget found that not until seven years, on the average, can a child "build a straight fence consistently in any direction across the table." He calls this ability the projective concept.

In the present investigation, four of the 14 four-year-olds, 15 of the 20 five-year-olds, and all of the six-year-olds placed the match sticks in a straight line in the diagonal direction as well as when the line was parallel with the edge of the table. Those who did not do this either put the sticks all over the cardboard or made a half-rectangle by following the edges of the cardboard. But if they were successful in one direction, they were also successful in the other direction.

C. SUMMARY

In summary, no evidence was obtained which supported Piaget's theories as to the development of stages or age levels in the acquisition of "mathematical and logical concepts." This study found (*a*) that if children could count, they counted correctly whatever the arrangement of objects; (*b*) they did not confuse extension of line with increase in number; (*c*) they did not mistake an apparent increase with a true increase in number; (*d*) if they could project a straight line in one direction, they could project it in another direction also.

The performance of eight of the 10 five-year-olds and all of the six-year-olds in the lower economic group was the same as that of the middle group. Thus economic level does not appear to be a variable.

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SEXUAL BEHAVIOR OF C57BL/10 MICE AND ITS RELATION TO EARLY SOCIAL EXPERIENCE*[1]

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A. INTRODUCTION

Socially dominant males have been shown to accomplish more frequent matings than their subordinates in flocks of chickens (4, 5), game cocks (3), sage grouse (9), and rhesus monkeys (2). When high ranking males have been tested alone with females, they do not always show more sexual activity than low ranking males (5). These observations suggest that the positive relationship between dominance and high levels of sexual activity is spurious, since in a competitive situation a dominant male merely has greater opportunities for matings. Sexual activity of subordinate males is inhibited by the presence of the dominant male. When the sexual and aggression tests are given independently, there is apparently no relationship between sexual behavior and aggression. However, no statistical measures of correlation have been employed to test for the significance of relationship.

If there is a relation between sex and aggression, the types of treatment which produce differences in aggressive behavior should also produce differences in sexual behavior. The early social experience of rats may produce differences in sexual behavior (1, 6). It has also been shown (7) that mice raised under different social circumstances display different amounts of aggression when paired with other mice. Does the same type of early social experience have an equal effect on both sexual and aggressive behavior? A positive answer to this question would suggest that sexual and aggressive drives are related. A negative answer would suggest that either sexual and aggressive drives are not related or that the relationship depends upon the situation.

B. METHODS AND MATERIALS

1. *Subjects*

The subjects were 20 adult male mice of the C57BL/10 inbred strain. They were divided into two groups: Group I consisted of 10 mice which

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were weaned and permanently isolated at 20 days of age. Group M consisted of 10 mice which were weaned at 20 days and raised with their father and male siblings until 45 days of age when they were permanently isolated. All mice were kept in two compartment wooden cages, 12" x 6" x 6". Food and water were supplied *ad libitum*.

2. *Apparatus*

Fighting tests were carried out in wooden cages similar to those in which the mice had been raised, except that the partition separating the compartments was removable. This permitted the mice to come together on an area double the size of their living cage. Half of this area was familiar to each of the combatants. Sexual tests were made in the living cages of the males.

3. *Procedure*

a. Aggression test. When the mice were 105-115 days old, each was paired with another male raised under similar circumstances. Each pair was given 10 trials on consecutive days. A trial consisted of removing the partition between the living cages of two isolated males and recording the length of time until the first vigorous fight began. The mice were separated after 5 seconds of fighting in order to prevent dominance. Each trial lasted either until the mice fought or for 5 minutes without fighting. The fighting response latencies were used as a measure of aggressive behavior.

b. Sexual test. Approximately 3 months after the mice were given aggressive tests, when they were 6 to 7 months old, they were tested for their sexual behavior. Female mice, which had been brought into estrus by .01 mg. injections of estrogen (Prygyron-B, Schering Co.) were first tested for receptivity by placing them with a sexually active male until an intromission was achieved. The females were then placed in the living cage of the males for 10 minutes each day for 10 days. The frequency of the male's reactions to the female were recorded for smelling body, smelling genitals, grooming, abortive mounting, mounting, intromissions, ejaculations, and attacks. The response latency to the first intromission was also taken.

C. RESULTS

The sexual behavior of mice raised in isolation did not differ from those raised in groups with their father and male siblings in frequency of smelling the body, grooming, abortive mounting, mounting, intromissions, attacks, and intromission latencies (Table 1). Mice raised with others of the same sex showed over twice as much smelling of the genitals of females as the mice raised in isolation. This difference was significant at the .001 level. Although the isolated mice ejaculated more frequently, the total frequency of ejaculations for both groups was too small for statistical treatment. There were only 22 ejaculations out of a possible 200 for both groups, counting one possible ejaculation per trial per mouse. It is interesting that the group which apparently showed most interest in the genitals of the females accomplished fewest ejaculations. Only one mouse is responsible for 73 of the 82 aggressive attacks shown by the isolated mice. This mouse made no mounts or intromissions and was one of the least aggressive mice in the aggression tests.

TABLE 1

SEXUAL BEHAVIOR IN GROUPS OF MICE RAISED WITH DIFFERENT SOCIAL EXPERIENCES

	Mean Group I	Mean Group M	Mean difference	*t*	P
Response latency	6.77	6.06	.71	0.74	.40
Smells body	46.1	40.2	5.9	1.10	.30
Smells genitals	32.1	65.2	33.1	4.02	.001
Grooms	64.4	54.4	10.0	0.99	.30
Abortive mounts	1.9	1.0	0.9	*	
Mounts	23.2	29.8	6.6	0.82	.50
Intromissions	19.9	25.8	5.9	0.73	.40
Ejaculations	1.5	0.7	0.8	*	
Attacks	8.2	0.6	7.6	*	

*Frequencies too few for statistical treatment.

Since the results for the aggression tests have been reported elsewhere (7), only the results of the sexual tests and their correlation with the aggression tests will be reported here. In correlating the sexual and aggression tests, the fighting response latency was used as the measure for aggression and both the intromission latency and the frequency of intromission were used as measures for the sexual tests. There was a correlation ($r = .87$, P .001) between the frequency and latency of intromissions. The ejaculation latencies and the number of ejaculations were too few in number for accurate estimation. Furthermore, the exact moment of ejaculation was difficult to ascertain by observation alone. Examination of the females after the tests for vaginal plugs were made as a check on the behavioral observations.

There was no significant correlation between fighting response latencies and intromission latencies in the 20 mice tested ($r = .08$, P .60) as shown by the scatter diagram in Figure 1 (Top). When the fighting response latencies were correlated with the frequencies of intromissions, again there was no significant correlation ($r = .02$, P .80) as might be expected, since the intromission frequency and latency were significantly correlated ($r = .87$). Figure 1 (Bottom) is a scatter diagram illustrating the relation between fighting latency and intromission frequency. These results indicate that sexual and aggressive drives are independent of each other and may only be related in situations where aggression is important in obtaining mates.

The sexual behavior of the mouse has been reviewed by Reed (8), who found contradictory reports among the investigators he reviewed. Although a complete study of the mouse's sexual behavior was not undertaken here, some observations were made during the testing procedure. The sexual behavior of the mouse is somewhat similar to that described for the rat (10) except that the female may possibly be more resistant to the advances of the male. The male must actively pursue the female and attempt to mount. If

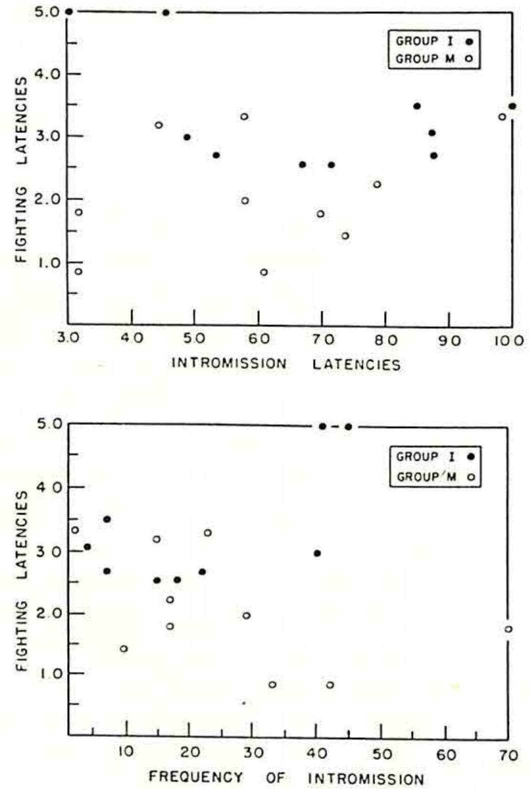

FIGURE 1

(*Top*). Correlation between fighting response latencies and intromission response latencies of 20 C57BL/10 male mice.

(*Bottom*). Correlation between fighting response latencies and frequency of intromission of 20 C57BL/10 male mice.

he is at all aggressive in grooming or nosing her, the female may become defensive and effectively fight him off or escape him, even when she will accept another male. Once the male has success in mounting the female, he grasps his forelegs about her abdomen and palpates with them while giving rapid pelvic thrusts. A receptive female readily submits to this behavior by lordosis, throwing up her head, and holding her tail aside. The rapid pelvic thrusts of the male appear to be searching movements for the vaginal oriface. Once the male has gained intromission, his pelvic thrusts become much slower and deeper. Ejaculation is seldom achieved at the first intromission. However, if ejaculation does occur it usually occurs during the first 4 intromissions; most ejaculations took place during the third intromission. No ejaculations occurred if the male made more than 6 intromissions during the 10 minutes of of the test. Some males make more than 6 intromissions, the maximum being 18, the median 9, the mode 2, and the mean 3.66 per trial.

The duration of the deep, slow pelvic thrusts characteristic of intromission may be as little as 5 seconds or may last well over a minute. Usually during the longer intromissions, ejaculation occurs and the male no longer continues his pelvic thrusts. He becomes very passive and usually falls over on his side with the female while maintaining vaginal contact. The entire course of intromission and ejaculation usually lasts about a minute, but in one mouse the entire course of copulation lasted 2:06 minutes. The male usually interrupts the copulatory act both before and after ejaculation, although at times the female will pull away. The sexual bond of the genitals is easily broken, but occasionally the female may pull the male a short distance *in coito*. While the male is giving the pelvic thrusts and palpating with his forelegs, the female jerks forward, with short rhythmic leaps. These leaps usually end shortly before or at ejaculation, when momentarily both animals are very lethargic and passive. After ejaculation, the males rarely approached the females for the duration of the test.

There are no vocalizations throughout the mating performance unless the female is initially defensive and squeaks at the approach of the male. A highly receptive female is silent.

D. Discussion

Previous social relations may affect the copulatory activity of rats (1), particularly if these relations are maintained until the introduction of a female in heat. No such effect of previous social relations on the copulatory behavior of mice was observed in the experiment presented here. However, the mice in this experiment had different social experiences only for 25 days, between the ages of 20 and 45 days after which they were isolated. Any possible immediate effect of the different social experience on the sexual behavior of the mice did not persevere after similar treatment of isolation for 6 months.

In contrast to its relatively minor effects upon sexual behavior a prepubertal exposure of 25 days to other males is sufficient to affect the aggressive behavior of adult male mice (7). This indicates that variation in aggression is more influenced by environmental circumstances than is variation in sexual behavior. Under the conditions of this experiment it is indicated that sexual behavior is more innately determined than aggressive behavior which is more plastic to the environment.

The failure to find a correlation between sex and aggression in mice confirms the work of Guhl (5) done with chickens. Apparently the relationship so often observed in free-living groups of animals, where the dominant male is also the most sexually active animal, is merely the result of the situation and does not indicate any relation between the two drives in an individual. The dominant male merely has greater opportunities to express himself sexually because he has subdued his rivals. It is even possible that a socially dominant animal may have less of a sex drive than his socially subordinate rivals. In polygynous groups of animals if the dominant male is less sexually motivated than his subordinates, he may expend his sexual drive before all the females have been bred, resulting in a number of unbred, barren females. The aggressive behavior of the dominant male may also lead him into so many combats with his rivals that the females may be bred by subordinate animals while the dominant male is fighting. Aside from these possible restraints on the sexual activity of the aggressive male, there appears to be little chance that the dominant male will diminish his sexual needs by fighting his rivals.

E. SUMMARY

Male mice raised in isolation from weaning do not differ in their sexual behavior from male mice raised with other males from weaning to 45 days of age and then isolated. There was a heightened display of interest in the genitals of the females among males raised with other males.

No correlation was found between sexual behavior and aggressive behavior when both groups are combined and given sexual tests three months after the aggressive tests.

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SISSINESS AND TOMBOYISHNESS IN RELATION TO SIBLING CHARACTERISTICS*[1]

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A. PROBLEM AND PROCEDURE

As part of a larger study of the effect of a sibling on the personality of the child, we explored the question of the relation of sissiness in boys and tomboyishness in girls to such characteristics of their sibling as his sex, ordinal position, and age difference.

Our subjects were 192 boys and 192 girls of ages five and six years from white, intact, native-born, urban, two-children families. These children were divided into matched sub-groups of 16 each, representing two ordinal positions, four possible child's-sex–sibling's-sex combinations, and three spacings, i.e., the sibs differed in age by under two, by two to four, or by four to six years. The matching of the 24 sub-groups was on an individual basis, age of child, socio-economic class of the father's occupation (2), and neighborhood of residence (5) being the characteristics considered in the matching (see Tables 1 to 3 for a description of the groups). A maximum deviation of nine months was allowed in the age matching but 98 per cent of the pairs were matched within six months. Ninety-three per cent were matched within one level on the Minnesota occupation scale (2) [Level 4, the farming group, was not represented in our population] and within one rank on the residence scale (5).

The measures of tomboyishness and sissiness were teachers' ratings of these qualities on a graphic scale on which three descriptions were offered

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TABLE 1
MEANS AND STANDARD DEVIATIONS OF THE DISTRIBUTIONS OF THE AGES

Description of group			Total number of subjects in group	Age difference between siblings seven to twenty-four months					
				Age of subjects (Months)		Age of siblings (Months)		Difference in age between subjects and their siblings (Months)	
Sex of subject	Sex of sibling	Subject's position in sibship		M	σ	M	σ	M	σ
M	M	2	16	71.38	6.14	89.56	6.85	18.19	3.61
M	F	2	16	69.31	6.23	87.75	7.65	18.44	3.30
F	M	2	16	70.44	7.70	89.31	7.50	18.88	4.06
F	F	2	16	71.31	5.24	90.63	6.34	19.31	4.07
M	M	1	16	68.38	6.08	50.06	5.99	18.31	3.42
M	F	1	16	71.38	7.36	53.31	9.14	18.06	4.15
F	M	1	16	70.44	6.31	52.69	7.13	17.75	4.24
F	F	1	16	70.94	5.71	51.38	6.87	19.56	3.60

as landmarks. For these descriptions, we borrowed from the California Behavior Inventory for Nursery School Children (1). The descriptions stress chiefly the possession by the child of activity interests and attitudes characteristic of children of the opposite sex. The checks on the graphic scale were converted into scores on a nine-point scale and these ratings in turn were normalized on the basis of a population of 498 five-and-six-year-olds, 4.00 being taken as the mean. An analysis of variance procedure was used to analyze the data. The Bartlett Test indicated there was no reason to assume that the sub-groups were drawn from populations with different variances. The error term used in computing *F* was the residual variance (see Table 6 for the analysis of variance data and Tables 4 and 5 for the group means).

The children were interviewed for 30 to 45 minutes about their relations with their sibling. The detail of this material will be presented elsewhere; but let us say here that every child was asked each question in our schedule and, when preferences were to be elicited, all categories of response were presented to the child for choice. For example, we asked, "Would you rather play with boys, with girls, or doesn't it make any difference?" We shall refer to the interview for supporting evidence only and present none of the data in tabular form.

B. RESULTS AND INTERPRETATIONS

Attention to the analysis of variance data in Table 6 bearing on sissiness in boys reveals that the age difference between sibs and the interaction be-

OF SUBJECTS AND OF THEIR SIBLINGS—TWENTY-FOUR BASIC GROUPS

Age difference between siblings twenty-five to forty-eight months						Age difference between siblings forty-nine to seventy-two months					
Age of subjects (Months)		Age of siblings (Months)		Difference in age between subjects and their siblings (Months)		Age of subjects (Months)		Age of siblings (Months)		Difference in age between subjects and their siblings (Months)	
M	σ	M	σ	M	σ	M	σ	M	σ	M	σ
70.88	6.07	105.63	6.77	34.75	6.70	68.94	6.17	129.63	7.97	60.69	7.79
71.81	6.33	108.88	8.82	37.06	6.35	73.13	7.03	131.75	10.79	58.63	5.97
72.25	6.50	107.69	10.02	35.44	5.84	71.88	4.26	125.69	7.53	53.81	4.96
72.81	5.42	107.94	8.42	35.13	6.26	67.63	5.13	123.69	6.61	56.06	5.13
71.06	6.55	35.00	8.31	36.06	6.58	72.75	6.69	18.25	6.94	54.50	5.82
70.88	6.04	32.31	8.82	38.56	6.92	72.31	7.51	16.75	6.65	55.56	5.43
71.75	7.19	37.88	11.60	33.88	7.09	70.56	5.53	14.75	7.19	55.81	4.49
72.44	5.56	37.56	6.27	34.88	6.02	73.38	5.71	17.13	5.95	56.25	5.79

tween sib spacing and ordinal position are significant. We had expected sib's sex to be an influential variable also, but it was not, although the general pattern of the sib-sex group differences we had anticipated—namely, that boys with a slightly older sister would be relatively sissyish—did obtain. Among second-borns, whether the sib is male or female, effeminateness tends to decrease as sib spacing increases, while in the case of first-borns, there is a decrease in the trait as the age difference between the child and his sib increases up to four years but a rise occurs at the four- to six-year level. Large ordinal position differences, with second-born boys exceeding first-borns, are to be noted only in the *MF* groups[3] at the spacings up through four years. At the widest sibling spacing, first-born boys are rated higher than second-born boys in femininity of interest and activity. Again it is the *MF* group in which the difference is the larger.

We are left, then, to explain the decrease in sissiness in boys as the age difference between them and their sib increases, whether the sib is male or female, and the greater sissiness of second-borns than first-borns at the closer spacings. Several possible mechanisms occur to us. If the older sib is a girl, but near in age, the boy's contact with her and her girl friends will be extensive. The sister, being older, will probably bring more friends into the home than the boy does and the former's friends will be chiefly girls.

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[3] In referring to a group we shall use the following code. The first letter will indicate the sex of the children; the second letter, the sex of the siblings; the unbracketted number, the ordinal position of the children; and the numbers in parentheses, the range of difference in age between the children and their siblings. Thus, MF1 (49-72) refers to first-born boys who had a sister 49-72 months younger.

TABLE 2

Distribution of Subjects in Twenty-Four Basic Groups in Terms of Father's Occupation

Description of group			Total number of subjects in group	Age differences between siblings seven to twenty-four months						Age differences between siblings twenty-five to forty-eight months						Age differences between siblings forty-nine to seventy-two months					
				Class of father's occupation																	
Sex of subject	Sex of sibling	Subject's position in sibship		I	II	III	V	VI	VII	I	II	III	V	VI	VII	I	II	III	V	VI	VII
				Number of subjects																	
M	M	2	16	5	–	4	7	–	–	5	3	4	3	–	1	–	5	4	6	–	1
M	F	2	16	2	3	5	5	1	–	5	2	5	4	–	–	2	5	3	4	2	–
F	M	2	16	3	3	3	7	–	–	5	5	2	2	2	–	3	5	4	4	–	–
F	F	2	16	4	4	4	3	1	–	4	4	3	4	1	–	2	3	4	4	3	–
M	M	1	16	4	1	5	4	2	–	6	2	2	6	–	–	5	4	4	2	1	–
M	F	1	16	5	1	2	7	1	–	6	2	2	5	1	–	6	2	3	1	3	1
F	M	1	16	3	2	5	6	–	–	5	5	1	3	2	–	2	4	4	4	1	1
F	F	1	16	3	4	4	5	–	–	3	4	6	3	–	–	4	4	3	4	–	1

TABLE 3

DISTRIBUTION OF SUBJECTS IN THE TWENTY-FOUR BASIC GROUPS IN TERMS OF NEIGHBORHOOD OF RESIDENCE

Description of group			Total	Age difference between siblings seven to twenty-four months					Age difference between siblings twenty-five to forty-eight months					Age difference between siblings forty-nine to seventy-two months				
				Socio-economic classification of neighborhood of residence														
Sex of subject	Sex of sibling	Subject's position in sibship	number of subjects in group	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
				Number of subjects														
M	M	2	16	8	3	3	1	1	6	5	2	3	–	11	3	1	–	1
M	F	2	16	8	3	–	3	2	10	1	4	–	1	9	2	1	4	–
F	M	2	16	8	5	2	1	–	11	–	2	2	1	11	3	1	1	–
F	F	2	16	11	3	–	2	–	8	2	2	4	–	7	4	2	2	1
M	M	1	16	9	1	1	3	2	9	1	5	1	–	10	1	3	1	1
M	F	1	16	9	4	3	–	–	8	1	5	2	–	8	1	5	2	–
F	M	1	16	8	1	3	2	2	10	4	2	–	–	12	1	1	2	–
F	F	1	16	6	6	1	2	1	8	2	5	1	–	14	–	–	1	1

TABLE 4

SISSINESS

Means of the normalized ratings for the various sub-groups

Description of groups				Age separation of siblings in months				
Subject's sex	Sibling's sex	Subject's position in sibship	Number of subjects	7-24	25-48 Means of normalized ratings	49-72	Total	Number of subjects in total groups
M	M	2	16	4.001	3.859	3.659	3.840	48
M	F	2	16	4.551	4.248	3.648	4.149	48
F	M	2	16					48
F	F	2	16					48
M	M	1	16	4.154	3.580	3.916	3.883	48
M	F	1	16	3.965	3.513	4.277	3.918	48
F	M	1	16					48
F	F	1	16					48
M	M or F	2	32	4.276	4.054	3.653	3.994	96
F	M or F	2	32					96
M	M or F	1	32	4.059	3.547	4.096	3.901	96
F	M or F	1	32					96
M or F	M	2	32					96
M or F	F	2	32					96
M or F	M	1	32					96
M or F	F	1	32					96
M	M	1 or 2	32	4.078	3.720	3.787	3.862	96
M	F	1 or 2	32	4.258	3.881	3.962	4.034	96
F	M	1 or 2	32					96
F	F	1 or 2	32					96
M	M or F	1 or 2	64	4.168	3.800	3.875	3.948	192
F	M or F	1 or 2	64					192
M or F	M	1 or 2	64					192
M or F	F	1 or 2	64					192
M or F	M or F	2	64					192
M or F	M or F	1	64					192
M or F	M or F	1 or 2	128					384

TABLE 5

TOMBOYISHNESS

Means of the normalized ratings for the various sub-groups

Description of groups				Age separation of siblings in months				
Subject's sex	Sibling's sex	Subject's position in sibship	Number of subjects	7-24	25-48	49-72	Total	Number of subjects in total groups
				Means of normalized ratings				
M	M	2	16					48
M	F	2	16					48
F	M	2	16	3.821	4.311	4.380	4.171	48
F	F	2	16	3.991	4.018	3.719	3.909	48
M	M	1	16					48
M	F	1	16					48
F	M	1	16	4.165	4.068	4.076	4.103	48
F	F	1	16	3.744	4.024	3.948	3.906	48
M	M or F	2	32					96
F	M or F	2	32	3.906	4.164	4.050	4.040	96
M	M or F	1	32					96
F	M or F	1	32	3.955	4.046	4.012	4.004	96
M or F	M	2	32					96
M or F	F	2	32					96
M or F	M	1	32					96
M or F	F	1	32					96
M	M	1 or 2	32					96
M	F	1 or 2	32					96
F	M	1 or 2	32	3.993	4.190	4.228	4.137	96
F	F	1 or 2	32	3.868	4.021	3.834	3.907	96
M	M or F	1 or 2	64					192
F	M or F	1 or 2	64	3.930	4.105	4.031	4.022	192
M or F	M	1 or 2	64					192
M or F	F	1 or 2	64					192
M or F	M or F	2	64					192
M or F	M or F	1	64					192
M or F	M or F	1 or 2	128					384

TABLE 6
ANALYSIS OF THE VARIANCE FOR VARIOUS TRAITS

		Trait					
		Tomboyishness			Sissiness		
Source of variance	df	Sum of squares	Estimate of variance	F	Sum of squares	Estimate of variance	F
Total	191	162.9146			163.4698		
Between groups	11	7.2794	.6618		17.8281	1.6207	
Within groups	180	155.6352	.8646		145.6417	.8091	
Between replications	15	9.9228	.6615		14.5989	.9733	
Residual	165	145.7124	.8831		131.0428	.7942	
Between variables							
Between sex groups	1						
Between sibling's—sex groups	1	2.7218	2.7218	3.082	1.4214	1.4214	
Between ordinal-position groups	1	.0936	.0936		.4200	.4200	
Between spacing groups	2	.8581	.4290		4.8308	2.4154	3.041
First-order interactions							
Subject's sex—sibling's sex	1						
Subject's sex—ordinal position	1						
Subject's sex—spacing	2						
Sibling's sex—ordinal position	1	.0266	.0266		.8993	.8993	
Sibling's sex—spacing	2	.6237	.3118		.0032	.0016	
Ordinal position—spacing	2	.2975	.1488		7.5879	3.7940	4.777
Second-order interactions							
Subject's sex—sibling's sex—ordinal position	1						
Subject's sex—sibling's sex—spacing	2						
Subject's sex—ordinal position—spacing	2						
Sibling's sex—ordinal position—spacing	2	2.6581	1.3290		2.6655	1.3328	
Third-order interaction							
Subject's sex—sibling's sex—ordinal position—spacing	2						

With these the boy will often play. It is significant that, in the interview we had with the children, only 33 per cent of the MF2 group at the closest spacing expressed a preference for male playmates, while 60 per cent of the parallel MM2 group did. Sixty per cent of the MF2 (7-24)'s named a male as best friend, while 80 per cent of the MM2 (7-24) group did. These data all suggest the influence of the older sister, when the sibs differ little in age, in determining the opportunity of the boy to play with girls and be exposed to their values, an experience which it seems reasonable to expect to affect his activity preferences and his interests. When the sister is more than two years older, however, then the two children in the family each tend to have their own coterie of friends, because the sex distance tends to be great in the elementary school years (Koch, 3). Eighty per cent of the MF2 (25-48) group said they preferred male playmates, in contrast to the 33 per cent of the MF2(7-24)'s when making a similar choice. At the widest spacing, when sib contact is limited and sex distance very great, the MF2 and MM2 groups do not differ in frequency of voicing a preference for male playmates. Both of these groups, let it be recalled, were judged very masculine.

The increasing male identification of MF2, as the age difference between him and his sib increases, is suggested in still another way. While at the closest spacing MF2's and MM2's expressed about equally frequently—50 and 47 per cent, respectively—the wish to change into—i.e., to become—the sib, at the widest spacing the comparable per cents are, respectively, 27 and 87. We think the *MF*'s were deterred often from wishing to become the sib because it would have involved a sex change.

The increase with spacing in male identification of the boy with an older brother may be due, as in the case of the boy with an older sister, to an expanding exposure to boys, though for a different reason. The older brother, since, as was mentioned earlier, the sex distance widens and reaches its maximum in the elementary school years, the older he is, has proportionally more male friends. Much scorn of girls and girls' activities is likely to be expressed. Little brother "has big ears" for such comments.

The interplay of forces among first-borns is somewhat different from what it is among second-borns. If the boy has a slightly younger sister, he is in the driver's seat and friends brought home are chiefly his. Hence, we think the male identification and interests of MF1 (7-24)'s, in comparison with MF2 (7-24)'s, should be rated, as indeed we found them to be, as the more marked. As the age difference between the first-born and his sib widens, then the contact they have with each other declines. The boy's friends will be increasingly boys, while the girl's friends will probably be girls, if perchance she has any. She may not have many friends, for instance, if she is very young. As evidence supporting the hypothesis stated above, let us mention the fact that the percentage of males among the playmates listed in the interview by the MF1's at the three spacing levels was respectively 53, 68, and 74.

Another type of possible influence may deserve some attention. Both the first-born boy and his sib, if the latter is near in age, will probably receive similar anxious and generally rather restrictive treatment from their inexperienced mother (see Lasko, 4; Sears, 8). This type of handling tends to foster seriousness and inhibition in children, qualities the teachers probably have associated with girls. The wider the age difference between the sibs, the more experienced the mother is when the second child arrives and, hence, the latter should more frequently be the recipient of a more relaxed and permissive type of guidance and should, accordingly, be relatively more active, aggressive, and self-confident than the first. This expectation is confirmed by other ratings we have.

To account in first-borns for the significant drop in sissiness with spacing up to four years, we have still another hunch. If the sib is two to four years younger, it is at that engaging one-to-five-year age when it receives much appreciation and loving, while at the same time it gets around considerably and interferes seriously with the older child's activities and possessions without being able to offer much compensating companionship. The older child is at the age, too, when, according to Lasko (4), the mother's attitude tends to shift to a more critical and less warm one than it had been. This situation, we think, is likely to activate the hostilities of the older child more than the one which obtains when the sibs are nearly the same age, receiving highly similar treatment and having many common interests; or far apart in age, the youngest then being merely an infant with whom no very vigorous interaction by the older child can occur. First-born males who have a sib two to four years younger, quite consistent with our hypothesis, are rated by their teachers as particularly jealous, demanding of adult attention, aggressive, active, vocal, exhibitionistic, and given to resistance and anger. No doubt, the teachers see these generalized aggressive tendencies developed by the thwarted older child as male qualities (see Tuddenham, 9).

As was mentioned earlier, if the sib is an infant, it is less of a competitor than when it is a preschooler. The former gets in the way less and is more obviously deserving of the services it receives. Hence it is resented less. Since, however, 40 to 50 per cent of the older children said they would like to change places with the sib—become the baby, if they could—one cannot assume the presence of an infant sib results in no conflict. Since its activities, however, interfere little directly with those of the older child, the latter is less motivated to "tear up the earth" and also has less opportunity for practice in rough activity. He is warned endlessly not to be rough with the baby. The defenses the older child learns, hence, probably will be less active ones than those the child at the middle spacing learns—defenses such as tattling, appealing to the adult for aid, etc. Other data we have show he actually does use these defenses with relatively high frequency. If he is rather inhibited, this may cause the boy to be judged by his teacher as less masculine than is the one whose sib is two to four years younger and who is particularly rebellious because the constellation of circumstances causes the sib's existence and activities to make for greater than usual frustration.

While the first-borns are probably increasingly with spacing discouraged by the parents from attacking the sib, the second-borns especially the boys, are, doubtless, increasingly with spacing encouraged to strike back and defend themselves. They are protected enough, too, so they often feel they have a fair amount of success in their quarrels. Fifty-three and 73 per cent of the MM2's and MF2's, respectively, at the four- to six-year spacing said, when interviewed, that they usually won when they quarrelled with the sib, whereas at the closest spacing, where strength and ability differences are much less and the younger child's chances of really winning are much greater, unless there are some tempering influences, the parallel per cents are 33 and 53, respectively. It is significant, too, that the MM2's at the widest spacing most frequently of all 24 sub-groups said they thought the mother sided with them when they quarrelled with the sib.

C. Tomboyishness in Girls

None of our independent variables is significantly related to tomboyishness, except sib's sex at the widest spacing. Here among the second-borns the girl with a brother is rated as more tomboyish than one with a sister. In the light of Rabban's (6) finding that in the age range from about 36 to 102 months boys are more clearly aware of sex-appropriate behavior than are girls, we had anticipated that the girls would show more sib influence than they did. Possibly girls are merely better conformists than are boys. Possibly too, the sib's influence is countered or masked by social pressure. Since the boy is more vigorous, he may even get approval for deviation in the direction of greater gentleness, quietness, conformity and reserve, traits which are feminine characteristics (Tuddenham, 9). The girl, on the other hand, if she imitates her brother and deviates in the direction of the greater aggressiveness and activeness which characterizes the male, is more likely to be disapproved and punished. Tuddenham (9) discovered that the qualities thought by school children and their teachers to be those characteristic of boys were more generally disapproved than were those thought to be characteristic of girls. Schoeppe, Haggard, and Havighurst (7) found a deviation from the social-moral code is more serious for the adolescent girl's social adjustment than a similar deviation on the part of the boy. This same pattern of social pressures may obtain at the preschool as well as school-age level.

Believing that possibly our female subjects were better satisfied with their sex rôle than our male subjects were, and that this might neutralize sibling influence, we looked for evidence bearing on this point. The evidence turned up supports, if anything, the opposite view. We computed the ratio between the frequency a wish to become the sib was voiced in the interview by the subjects in those groups in which the sibs are opposite in sex and voiced by those from pairs in which the sibs are of the same sex. These ratios for the two sexes are as follows: $\frac{\mathrm{MF2}}{\mathrm{MM2}}, \frac{\mathrm{FM2}}{\mathrm{FF2}}, \frac{\mathrm{MF1}}{\mathrm{MM1}}, \frac{\mathrm{FM1}}{\mathrm{FF1}}$. (See Table 7.) Although it can be assumed that willingness to metamorphose into the sib is governed by many considerations, the ratios should suggest roughly the extent to which the thought of a change in sex was a deterrent to the desire to exchange rôles with the sib.

Among second-borns, girls seem relatively more willing to metamorphose into the sib, when that would involve a change in sex, than the boys are. In the case of second-borns there is a decrease, as the age difference between the sibs increases, in inclination to make the sex change. The picture is not so clear-cut in the case of first-borns, but there seems some increase with spacing, from the closest to the middle and to the widest, in willingness to change sex.

D. Summary

The question explored was the relation of sissiness in boys and tomboyishness in girls to the following characteristics of their sibling: his sex, ordinal position, and difference in age.

The subjects were 192 boys and 192 girls of ages five and six years from white, native-born, intact, urban, two-children families.

None of the sibling variables was significantly related in the total population to tomboyishness in girls, though there was a strong suggestion that girls with a brother more than two years older have a tendency to be relatively tomboyish.

In the case of sissiness in boys the interaction of ordinal position of the child in his sibship and spacing was significant. Among the second-borns sissiness tended to decrease as the age difference between the sibs increased, while among the first-borns the decrease with sib spacing occurred only between the under-two to the two-to-four-year and to the four-to-six-year spacings. From the middle to the four-to-six-year spacing there was an increase in sissiness. At the spacings up to four years second-born boys with sisters were more sissyish than were first-born boys with sisters, whereas, when the sibs differed by more than four years, the relationship between first- and second-borns was reversed.

TABLE 7

RATIO OF THE FREQUENCY WITH WHICH THOSE FROM OPPOSITE-SEX SIB PAIRS AND SIMILAR-SEX SIB PAIRS EXPRESSED A DESIRE TO BECOME THEIR SIB

	Spacing in months		
	7-24	25-48	49-72
Ratio type		Ratios	
$\frac{\text{MF2}}{\text{MM2}}$	.85	.57	.31
$\frac{\text{FM2}}{\text{FF2}}$	2.35	1.00	.57
$\frac{\text{MF1}}{\text{MM1}}$	.35	3.07	.80
$\frac{\text{FM1}}{\text{FF1}}$	.40	1.00	.85

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DISCRIMINATION OF VISUAL PATTERNS AS A FUNCTION OF MOTIVATION AND FREQUENCY OF REINFORCEMENT*

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A. PROBLEM

This experiment is concerned with the effect of frequency of reinforcement and of deprivation time on the discrimination of bidimensional patterns by monkeys. It has been shown (5) that the accuracy with which monkeys discriminate stereometric objects is not significantly affected by degree of food deprivation. Nor is the solution of reversed discriminations significantly dependent upon the number of reinforcements given before reversal, in sophisticated monkeys trained in discriminating objects (7).

Recent investigations (1, 3, 6) have indicated that the perceptual characteristics of the stimuli employed in studying discrimination learning by monkeys have a profound effect on rate of intraproblem learning and interproblem transfer. Specifically, the use of bidimensional patterns instead of the more commonly employed stereometric objects results in relatively slow and continuous intraproblem learning, and relatively retarded learning set formation.

Since, as mentioned above, large quantitative differences exist in the rate with which monkeys solve discriminations between patterns and between objects, it seemed desirable to determine again the dependence of efficiency in discriminative learning upon motivation and frequency of reinforcement. Use of the more difficult patterned stimuli would provide a more general test of the validity of the results reported by Meyer (5) and Warren (7).

B. PROCEDURE

1. *Subjects*

Four rhesus monkeys served in this experiment. These *S*s had received extensive tuition in an experiment on the concept of number. All of the

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stimuli used in that investigation were patterns so that these *S*s were quite familiar with the sort of materials used in the present experiment.

2. *Apparatus*

The testing was conducted in the Wisconsin General Test Apparatus. This apparatus has been described in a previous publication (2). The stimuli were 72 different pairs of geometrical figures cut from colored construction paper and mounted on 3″ x 3″ squares of white posterboard. Each pair of stimuli differed in form (cross, square, circle, triangle, rectangle, diamond, quadrant, semicircle, rhombus, and trapezoid) and size (1.8 or 3.6 sq. in. in area). No form or size was consistently rewarded; the color of the two forms was constant within each pair but was varied from problem to problem in order to minimize interproblem transfer.

3. *Testing Procedure*

The members of each pair of stimuli were randomly designated as + (correct) and — (incorrect); choice of the + stimulus during discriminative training was rewarded with a raisin or peanut while choice of the — stimulus was not rewarded.

Before the discriminative training with paired presentation of the + and — stimuli was begun, the animals received eight preliminary trials with a single stimulus, and displacement of this object was always rewarded. With respect to the performance required in the subsequent discriminative problems, three conditions obtained during preliminary training: (*a*) the + stimulus was presented alone and rewarded eight times; (*b*) the + and — stimuli were each rewarded four times in random order; (*c*) the — stimulus was presented and rewarded eight times. Conditions 1, 2, and 3 represent 100, 50, and 0 per cent reinforcement of the + stimulus. Immediately after the eight preliminary trials were given, six discriminative trials were given, with the + stimulus consistently rewarded. The noncorrection technique was used throughout the experiment. Six problems (two problems of each reinforcement condition) consisting of eight preliminary and six discriminative trials were presented each day for 12 consecutive days. One-half of the testing sessions were conducted one hour, and the remainder 23 hours, after the *S*s had access to their normal ration for a period of one hour. The two periods of deprivation were alternated according to the *ABBA* sequence.

4. *Experimental Design*

The design employed was a 4 (animals) x 3 (reinforcement) x 2 (deprivation) x 2 (problem blocks) factorial. The data were arbitrarily divided into two 6-day periods in order to evaluate the significance of interproblem learning.

C. RESULTS

The analysis of variance indicated that frequency of reinforcement was the only significant source of variation ($F = 12.48$, $P < .01$ with 2/6 *df*). Strength of motivation was not significant (only 1.25 per cent more errors were made under 1 than under 23 hours of hunger) nor were any of the other main effects or interactions.

The *S*s averaged 81, 75, and 61 per cent correct responses on discriminative Trials 2 to 6 following preliminary training in which the + stimulus was rewarded 100, 50, or 0 per cent of the eight pretraining trials. The effect of the proportion of + reinforcements during pretraining upon subsequent performance on the discriminative trials is shown in Figure 1 which shows intraproblem learning after the three conditions of pretraining. It is readily apparent that eight reinforcements of the — pattern produced severe retardation on learning the discriminative problems; indeed the *S*s performance never reached the level attained on Trial 2 under the other two conditions.

D. DISCUSSION

The results of the present experiment confirm the findings previously reported by Meyer (5) that increased hunger motivation has no significant effect on the monkeys' performance in discriminating stereometric objects.

However, the findings reported here contradict the results reported by Warren (7) with respect to frequency of reinforcement. He reported that the performance of sophisticated monkeys on reversed discriminations did not vary significantly as a function of the number of prereversal reinforcements over a range of 1-32. Since the *S*s used in the present experiment were also sophisticated, it must be presumed that the difference in the results obtained in the two studies was determined by the difference in the stimuli employed. It may be concluded then, that continuous learning in which performance is proportional to the number of + or — reinforcements received can be demonstrated in sophisticated monkeys tested on perceptually difficult stimuli as well as in experimentally naïve *S*s tested on perceptually easy problems (7).

Finally, it should be noted that this experiment duplicates in many respects several studies of learning in monkeys and chimpanzees which are reported in Lashley and Wade's (4) critique of the Pavlovian theory of stimulus generalization. These authors concluded "that any strength of association established by 200 positive reactions to a single stimulus is insignificant in

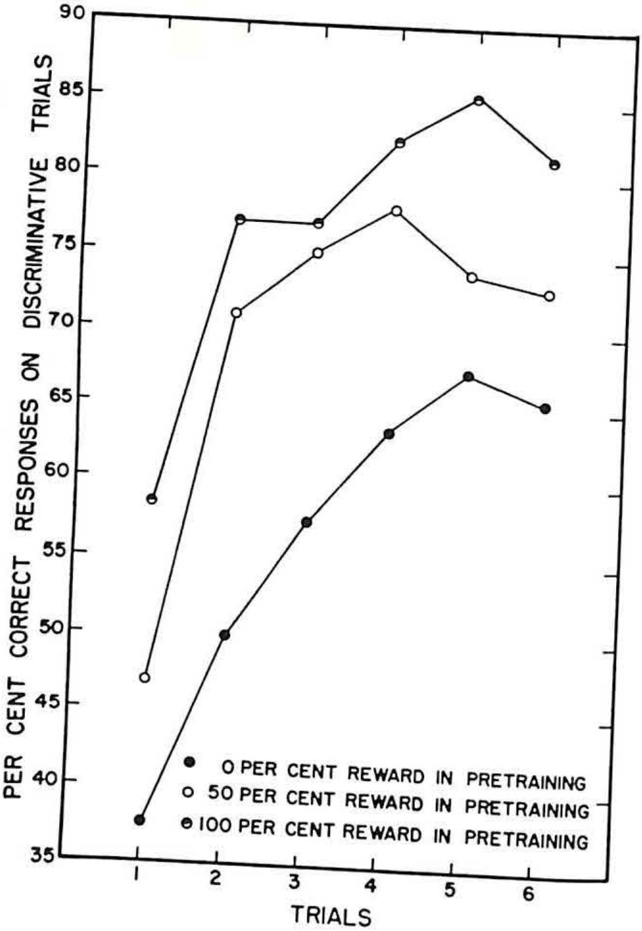

FIGURE 1
DISCRIMINATION LEARNING AS A FUNCTION OF ANTECEDENT REINFORCEMENT

comparison with other factors which modify the rate of learning" (4, p. 77). The discrepancy between the results reported here and those described by Lashley and Wade probably resulted from the failure of the latter experimenters to employ sufficiently sensitive measures or to test their animals on an adequate number of problems.

E. SUMMARY

A group of four monkeys were tested on a series of 72 discriminative problems; each problem required a discrimination between two patterns differing in form and size. Each of the discriminative problems was preceded by one of three types of preliminary training: the + stimulus was rewarded eight times, the + and — stimuli were each rewarded four times, or the — stimulus was rewarded eight times. All presentations during preliminary training were of a single stimulus. Testing occurred under either 1 or 23 hours of food deprivation.

Analysis of variance revealed that frequency of reward during pretraining was the only significant source of variation. The results were interpreted as indicating that even experimentally sophisticated monkeys follow the continuity description of learning when tested on perceptually difficult problems.

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RESPONSES OF JUVENILE DELINQUENTS TO THE THEMATIC APPERCEPTION TEST*

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A. PROBLEM

From preliminary trials with the test, it seemed evident that the Thematic Apperception Test by Murray (6) was a valuable means of discovering significant material concerning juvenile delinquents.

B. PROCEDURE

The present investigation is based upon 34 boys and 34 girls who were tested while in one of the three following institutions (1) for juvenile delinquents: Bureau of Juvenile Research, Columbus, Ohio, 13 boys and 7 girls; Training School for Girls, Adamsville, Georgia, 27 girls; Training School for Boys, Milledgeville, Georgia, 21 boys. The age range for boys was 10 years 6 months to 17 years, with a mean of 14 years 9 months. The girls were somewhat older, the mean age being 15 years 10 months, and the range 11 years 9 months to 17 years.

Intelligence test scores were not available for the Georgia cases but Stanford-Binet or Wechsler records were secured for the Ohio subjects, as follows: for boys, the mean *IQ* was 94 and the range 77-118; for girls, the mean *IQ* was 91, and the range 79-114.

For the 34 boys of the present study, stealing was the most frequent offense, with running away as second in occurrence. For girls, incorrigibility was the leading complaint, with implications of immoral behavior in the majority of cases. Running away was recorded in nearly three-fourths of the 68 histories.

In administering the test in a preliminary study it was found that juvenile delinquents sometimes objected to sitting with the back to the examiner, as suggested in the manual (6). In the present study the child faced a blank wall, while sitting at a table to the left of the experimenter.

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[1] The author wishes to express appreciation to the superintendents and staff members of these three institutions for making possible the testing of the subjects. Special thanks are due Dr. Maurice Newburger for permitting access to the records of the cases tested at the Bureau of Juvenile Research, Ohio.

Form *B* directions, designated by the manual (6) as suitable for children, were followed in giving the test. The 16 cards were given on the same day, with an intermission not exceeding 30 minutes at approximately the middle of the test. The writer gave all the tests, recording and analyzing all the responses.

The same 16 cards were used for all subjects, thus facilitating comparisons of boys and girls. The blank card, 16, was given last. The following cards were employed: (1) Boy and violin; (2) Rural scene with three persons; (3 BM) Huddled figure by couch; (3 GF) Girl with hand covering face; (4) Woman clutching man's shoulder; (5) Woman looking into room; (6 BM) Elderly woman and young man; (7 BM) Two men; (7 GF) Woman, girl, doll; (8 BM) Boy and surgical operation on man; (10) Woman's head on man's shoulder; (12 BG) Rowboat by stream; (13 B) Boy and log cabin; (14) Silhouette of person against window; (17 BM) Man clinging to rope; (16) Blank card.

C. Results

A parental trait listed in Table 1 often occurred only once in a child's record of 16 stories. Thus the total number of themes containing a given characterization ordinarily is very similar to the number of children describing that parental rôle. For the first category, "hurt, ill or dies," 12 different boys had a total of 19 stories describing the father-person in this manner. For the other categories in Table 1, the figures are even more nearly alike, making unnecessary the presentation of the "total number of themes" containing a given trait. No references to parent-persons were used except those which were verbally expressed and therefore definitely identifiable as allusions to father and mother figures. It was the feeling of the examiner that the majority of the subjects tried to make what Weiskopf and Dieppa (8) term "a good impression," which affected the responses to an unknown degree.

For delinquent boys in this study, the most frequent reference to the paternal figure, 38.2 per cent, was in the rôle of advising the child or youth. A response with more negative implications is seen in the description of the father-figure by 35.3 per cent as "hurt, ill or dead." Of this group, 20.6 per cent specified that the son shot the father. Nearly one-third of the boys portrayed the male parent as being angry with the child. That the latter is sometimes blamed is implied by the fact that 23.5 per cent described the child as having disobeyed the father. Nearly one-fourth of the boys referred to the father as being absent from home.

Especially is the delinquent girl impressed by the paternal rôle of working and/or earning, respective depictions by girls and boys being 64.7 per cent and 32.4 per cent. More girls than boys, 47.1 per cent as compared with 35.3 per cent, spoke of the father as "hurt, ill, or dead," but no girl described the child as instrumental in causing the tragedy. More girls than boys, 38.2 per cent as compared with 26.5 per cent, referred to the poverty of the father-person. About twice as many girls, 23.5 per cent vs. 11.8 per cent, spoke of the father as punitive.

TABLE 1
RÔLE OF PARENTS DESCRIBED BY 34 DELINQUENT BOYS AND 34 DELINQUENT GIRLS RESPONDING TO 16 *TAT* CARDS

	Father		Mother	
	Boys %	Girls %	Boys %	Girls %
Hurt, ill, or dies	35.3	47.1	11.8	50.0
Shot by son[a]	20.6	0	0	0
Angry with child	32.4	8.8	14.7	47.1
Punishes child	11.8	23.5	26.5	76.5
Locks child in, out[a]	5.9	8.8	11.8	32.4
Child disobeys	23.5	17.7	17.7	38.2
Child runs from[1]	2.9	14.7	20.6	26.5
Child returns to[1]	0	0	17.7	17.7
In poverty	26.5	38.2	2.9	20.6
Refuses child's wishes	14.7	17.7	17.7	70.6
Away from home[2]	23.5	20.6	8.8	17.7
Requires work[3]	14.7	11.8	29.4	52.9
Hunts for child	2.9	0	26.5	47.1
Advises child	38.2	26.5	11.8	32.4
Works, earns	32.4	64.7	29.4	23.5
Proud of child	11.8	2.9	2.9	0
Gift to child	20.6	14.7	2.9	8.8
Fixes toy	20.6	5.9	5.9	0
Fun with child	14.7	5.9	5.9	14.7
Loves child	5.9	23.5	14.7	20.6
Helps child	8.8	11.8	2.9	0
Child helps parent	8.8	2.9	23.5	17.7
Forgives child	17.7	14.7	32.4	47.1
Cares for child[4]	14.7	2.9	20.6	44.1

[a] Frequencies are included also in preceding classification.
[1] Leaving home, and returning home after running away from home.
[2] Working, on trips, etc.
[3] Or study, or practice, etc.
[4] Physical care, as fixing meal, caring for when sick, etc.

To the delinquent boy, the mother is the punitive parent, 26.5 per cent mentioning her in this rôle, while only 11.8 per cent referred to the father thus. She also is the parent more frequently requiring the child to work, study, or practice, respective proportions for mother and father being 29.4 per cent and 14.7 per cent. The delinquent boy depicts the child as running away from the mother-person, 20.6 per cent, much more than from the father-person, 2.9 per cent. Correspondingly, the delinquent prodigal is described by 17.7 per cent of the boys as returning home to the mother, and nearly one-third mention that she is forgiving.

To the delinquent girl also, the mother is the punitive parent, more than three times as many referring to the mother as the father in this rôle. Respective proportions are 76.5 per cent and 23.5 per cent. About three times as many girls as boys portray the mother as punishing the child. It is the mother, according to 52.9 per cent of the delinquent girls, not the father, reported by only 11.8 per cent, who requires the child to work, study, or practice.

Both parents are portrayed by approximately half of the delinquent girls as "hurt, ill, or dead." Nearly one-half describe the mother as angry with the child, while the father is so depicted by only 8.8 per cent of the girls.

It is the mother rather than the father from whom the delinquent girl is likely to be running away. About half of these girls describe the mother as hunting the child, and the same proportion depict her as forgiving the youngster. Self-blame is indicated in the fact that 38.2 per cent of the girls described the child as having disobeyed the mother.

A more comprehensive indication of attitudes may be obtained by combining the proportions for the five categories: hurt, ill, dead; angry with child; punishes child; child runs from; refuses child's wishes. For delinquent boys, the totals for father and mother are similar, 97.1 per cent and 91.3 per cent. For delinquent girls, the totals for the parents are strikingly different, 111.8 per cent and 270.7 per cent, respectively. More delinquent girls than boys express what seem to be unfavorable attitudes to both parents, the girls being especially outspoken with reference to the mother-person.

Of the 34 girls, six (17.7 per cent) made no reference to the father-figure in any of their 96 themes. Four of these had been reared from infancy in homes where there was no father.

A comprehensive picture of more desirable attitudes may be obtained by combining proportions for the nine categories which follow: advising child; helping child; proud of child; giving gift to child; fixing toy; fun with child; loving child; caring for child (physical care); forgiving child. For delinquent boys, the totals showed a definite paternal preference, respective proportions being 153.0 per cent and 100.0 per cent. For both parents, the totals given by boys for desirable traits are larger than for undesirable rôles, and this is particularly true in the case of the father, the totals being 153.0 per cent and 97.1 per cent. For the mothers, the proportions, 100 per cent and 91.3 per cent, are very similar.

Delinquent girls tend to depict undesirable, rather than desirable traits in both parents. For the father-person the totals, 111.8 and 108.8 per cent, are very similar. For the maternal figure, respective totals are 270.7 and 167.7, indicating a strong tendency to express relatively unfavorable reactions to the mother-person.

An attribute of the hero or heroine, as indicated in Table 2, is listed only once per child regardless of the frequency of occurrence of that trait for a given youth. Many of the attributes given in Table 2 were present in three or four themes told by a child, which is a different finding from that noted for the data of Table 1. The attributes of Table 2 are those of the hero or heroine with whom the subject seemed to be identifying. Such identification usually had to be inferred, since the child did not often verbalize the identification clearly. This procedure again differed from that of Table 1, which is based upon actual use of the words "mother" or "father," or synonyms.

TABLE 2

SELF-CONCEPTS OF JUVENILE DELINQUENTS AS INDICATED BY THE *TAT*

Attributes[1]	Boys %	Girls %	All %
Abasement	23.5	17.7	20.6
Achievement[2]	70.6	88.2	79.4
Aggression[3]	85.3	94.1	89.7
(a) Emotional-Verbal	55.9	73.5	64.7
(b) Physical-Social	29.4	20.6	25.0
(c) Physical-Asocial	50.0	32.4	41.2
(d) Destruction	20.6	14.7	17.7
Domination	23.5	41.2	32.4
Intragression[4]	73.5	91.2	82.4
Nurturance	35.3	29.4	32.4
Passivity	14.7	8.8	11.8
Sex	91.2	100.0	95.6
Succorance; love[5]	100.0	100.0	100.0
Acquisition[6]	64.7	85.3	75.0
Failure[7]	44.1	61.8	52.9
Conflict	38.2	50.0	44.1
Rejection[8]	29.4	38.2	33.8
Running away	41.2	35.3	38.2

[1] Of hero or heroine with whom subject seems to identify.

[2] Includes success in any field, vocational, athletic, school, etc.

[3] Includes the four sub-heads, a-d. Subjects often reacted in more than one category.

[4] Includes *dejection,* as listed by Murray (6).

[5] Includes desire for love, especially parental.

[6] Especially money, luxury, i.e. material possessions.

[7] Failure to achieve goal or wish.

[8] Rejection by anyone.

Unless otherwise stated, the attributes given in Table 2 are mainly in accordance with Murray's (6, pp. 9-10) terminology.

Each delinquent in the present study recounted one or more stories indicating the need of the hero or heroine for succorance and/or love, which includes parental affection. It seems probable that, especially for the delinquent girl, this type of need was not being adequately satisfied, particularly with reference to the mother (Table 1).

All girls and 91.2 per cent of boys gave one or more themas describing heterosexual behavior on the part of the hero or heroine. Since most of the subjects were adolescents this is to be expected. Almost all the stories by girls (Table 1) which depicted the hero or heroine as being locked in or out, involved heterosexual behavior.

Aggression as the attribute of the central character was described by 89.7 per cent and this was predominantly (64.7 per cent) emotional and verbal in type, especially for girls. Half of the male subjects depicted the hero as engaged in asocial physical aggression.

Almost as characteristic as the aggressive pattern was the intragression-dejection syndrome. The latter is more typical of girls than boys, respective proportions being 91.2 per cent and 73.5 per cent. For girls, the aggression and intragression-dejection attributes have similar frequencies. For boys, the aggressive traits are outstanding, respective proportions being 85.3 per cent and 73.5 per cent.

Another need (Table 2) is included under the heading of acquisition, which refers to the desire for material possessions. This was indicated by three-fourths of the subjects, approximately 85 per cent of the girls and 65 per cent of the boys. It is surprising that more girls than boys expressed this need, inasmuch as the majority of the latter were in custody because of thefts. It will be recalled from Table 1 that girls more than boys were impressed by poverty. That some of the stealing by boys arises from the desire to supply the wishes of females for material possessions was the inference from some of the data.

Depiction of the hero or heroine as achieving the desired goal was noted in 79.4 per cent, with the tendency being considerably stronger in girls. Many of the girls referred to achievement as being in spite of the mother's refusal of the child's wishes (Table 1). This flaunting of maternal authority seems to have been half-hearted, judging by the fact that 61.8 per cent of the girls gave at least one story in which failure to achieve the goal was characteristic. The proportion of boys indicating such failure was only 44.1 per cent.

In accordance with Gerver's procedure, as described by Coleman (1), the 1,088 stories told by the subjects were analyzed on the basis of five levels in Table 3. Only 1.7 per cent were of the first level of no response. A small proportion, 4.0 per cent, were enumerative, and 15.9 per cent were descriptive of action. The largest number, 78.4 per cent, fell in the two interpretative groups. These subjects had experienced numerous frustrations, a study of which has been made by Crandall (2). Despite the possible effects of frustrations these cases had a relatively high proportion of stories at the interpretative levels.

TABLE 3

PROPORTION OF STORIES ON EACH OF FIVE LEVELS

Level	Type reaction	Boys	Girls	All
1	No response	2.2	1.1	1.7
2	Enumeration	4.6	3.5	4.0
3	Overt description of action	14.9	16.9	15.9
4	Interpretation of kinship, type, feeling, etc.	47.8	43.0	45.4
5	Interpretation of feeling about others; full plot	30.5	35.5	33.0

TABLE 4

RELATION BETWEEN EMOTIONAL TONE IN PLOTS AND ENDINGS

	Ending											
	Happy			Unhappy			Neutral			None		
Plot	B	G	All	B	G	All	B	G	All	B	G	All
Happy	15.2	10.4	12.8	7.9	12.7	10.3	2.0	0.8	1.4	1.2	1.0	1.1
Unhappy	31.8	34.5	33.1	18.9	21.0	20.0	3.6	4.2	3.9	7.1	4.1	5.6
Neutral	4.7	6.0	5.4	2.6	1.5	2.1	1.8	2.5	2.1	3.4	1.4	2.3

Only themas of Levels 3, 4, and 5 have been included in Table 4, which indicates the relationship between the emotional tone in the plots and endings. As suggested by Rotter (7), the endings were analyzed independently of the body of the story. He calls an ending "unrealistic" when it is not consistent with the plot. In the present study all endings, both spontaneous and elicited, have been included.

Of the 1,026 themas in Table 4, those with unhappy plots occur most frequently, the total being 62.6 per cent. Only about one-fourth could be classified as happy. About one-third shifted from an unhappy plot to a happy ending, but only 10 per cent changed a happy plot into an unhappy termination. Nearly 20 per cent of the themas had an unhappy tone predominating throughout, that is, both in plot and ending, whereas, only 13 per cent were consistently happy in tone. Approximately seven per cent of the stories had neutral endings, and nearly nine per cent had no endings. Over half the endings were optimistic, while about one-third were pessimistic.

It is not surprising that unhappy plots predominate for these subjects inasmuch as it appears (3) that the *TAT* pictures elicit primarily sad stories. Possibly the insistence upon a happy termination may have special significance for these disturbed subjects. From an analysis of all the available data concerning this group it appeared that their prognosis was better than that of the consistently pessimistic cases. This problem, however, needs further investigation.

D. Summary and Conclusions

The present report describes the results from administering 16 *TAT* cards to 34 delinquent boys and 34 delinquent girls. Subject to the limitations of the present sample, the following conclusions are offered:

Delinquent boys most frequently refer to the paternal figure (38.2 per cent) as advising the child. More than one-third of the boys described the injury, illness, or death of the father and 20.6 per cent specified that the son shot the father. On the basis of desirable attitudes ascribed, the delinquent boy appears to admire the father more than the mother. He sees more good than bad in both his parents.

Delinquent girls tend to depict undesirable rather than desirable traits in both parents, and this is significantly true in case of the mother. The delinquent girl is impressed by the paternal rôle of working and earning, and by the reality of poverty.

To both boys and girls the mother is the more punitive parent, the person who requires work, study or practice, and the one from whom the child runs away. Apparently many of the homes represented in the present study were matriarchal in type.

The following themes, which seem to reveal needs of the subjects, were described by the majority: succorance and/or love; heterosexual behavior; aggressive behavior; intragressive-dejection syndromes; desire for material possessions; achievement; and failure.

Unhappy plots occurred most frequently, the proportion being 62.6 per cent. About one-third of these plots were changed to have happy endings. Nearly 20 per cent of the themes had an unhappy tone throughout, that is, both in plot and ending.

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LEISURE-TIME ADJUSTMENT OF THE AGED: II. ACTIVITIES AND INTERESTS AND SOME FACTORS INFLUENCING CHOICE*[1]

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A. PROBLEM

A limited amount of dependable information exists about elderly people. This lack is evident especially in the area of leisure-time activities and interests. Students of psychiatry, psychology, sociology, and recreation, have deplored this lack of scientific data about the leisure-time pursuits and wishes of older persons. Despite the sounding of the tocsin as early as 1595, by Gabriele Paleotti (3), on the need for systematic study of the various phases of senescence, the 1948 research planning report of the Social Science Research Council, *Social Adjustment in Old Age*, states:

> The changes affecting the participation of older people in the fields of recreation, education, politics, and religion have received so little attention that the fund of relevant knowledge is hardly sufficient to serve as a basis for making specific research proposals. For the time being, therefore, investigatory efforts in these four institutional fields will have to be largely exploratory (2, p. 153).

The purpose of this investigation was to discover the extent and the nature of the leisure-time activities and interests of persons 65 years of age or more residing in homes for the aged or attending recreation centers in New York City, to compare the extent and nature of the activities and interests of these groups, and to compare the association of certain psychological and socio-economic characteristics to these activities and interests.

This study was limited to persons 65 years of age or more, in New York City, who dwelled in old age homes or who attended old age recreation centers. This choice of population was made since these two groups differ in their mobility and social organization. Only those persons willing and able

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[1] This study was reported at the annual meeting of the American Psychological Association, State College, Pa., 1950. It is a portion of a doctoral dissertation done at New York University under the guidance of Dr. Brian E. Tomlinson in 1950. The complete mms. is available as microfilm publication No. 1813, 274 pages, $3.43, from University Microfilm, Ann Arbor, Michigan.

to coöperate were considered. Subjects who did not comprehend the questions because of inability to converse in English, mental retardation, dementia, or serious deterioration were excluded. Activities for the past year, only, were considered to obviate any memory difficulties such as confabulation or inability to recall.

B. PROCEDURE

Stratified-random samples from two distinct milieux were interviewed individually, 108 persons in seven old age homes and 108 persons in seven recreation centers for the aged. The subjects were over 65 years of age and varied in sex, race, religion, occupation, employment status, desire for employment, education, living arrangements, birthplace, rural or urban upbringing, economic identification (by choice, not income), and marital status. Table 1 demonstrates the sampling of the population. Some variables proved to be nonsignificant; others were broken down more precisely than was pertinent to this study; these attempts to give proper stratification do not all appear. The interviews covered, in part, the extent and nature of activities participated in often (as subjectively felt) and interests.

A questionnaire and checklist, similar to one used by the National Recreation Association (1), was developed to tap areas in which senescents spend leisure-time. Criteria for construction included broad content coverage; ease in comprehension; allowance for limitations in attention span, intelligence, reading ability, and fatigue; item interest and relevance for the elderly; recency of phenomena; and flexibility in administration to allow either interviewer or subject to fill in the information. Since the information sought had meaning for and was to be used for the benefit of the persons interviewed, it is believed that validity was increased. Two informal checks on validity were made. The data were spot checked against the available opportunities for the individual in question and against the observations of the professional workers in the institutions.

Over 200 items were presented in the questionnaire. To facilitate communication and treatment of the data, they were consolidated into groups as listed in the tables. During the discussion with the subject the examiner checked off pertinent information and used the checklist to stimulate the thinking of the subject.

C. RESULTS

The institutions, as units, were divided into odd and even groups for the two samples, and t ratios between the two halves of the home and center populations were computed for the nature of the activities and interests. For the nature of the activities seven significant ratios appear. For the nature of the interests nine significant ratios occur. Sampling consistency is at issue since 3.75 significant ratios are acceptable at the .05 level for 75 tests. The sampling and experimental precautions and the statistical tests of significance would point to differences in administrative philosophy and programming rather than to differences in the consistency of the two samples as the probable cause for any lack of homogeneity present. This potent influence cannot be considered a constant error. Although more clearly operative in the homes its exact nature or direction of effect is variable and seems to be related to the way in which the traits affect the choice of activities and interests. It would appear to be a cultural difference, for the philosophy and practices of some of the centers and all of the homes are themselves characteristic, to some degree, of the sponsoring organization and the unique composition of the inhabitants along the lines of religion, nativity, and socio-economic status.

1. *Extent of Activities and Interests*

The task of relating the extent of the actual or desired participation in leisure-time activities of the subjects of this study with the extent found in other works was not advisable. The concepts of leisure and its component activities vary, and the means of organizing and presenting the data usually differ too greatly to allow accurate comparison.

a. Extent of activities for the home population. The means for extent of participation in activities run from 9.27 for the high education group to 6.45 for the service occupation group in Table 1. Other groups which had high means were the professional-technical-managerial and the Protestant. Low were the Negro, Catholic, poor, and full-time employment-seeking groups. The homogeneity of these groups is revealed in the sigmas which spread from 1.33 to 3.49; most, however, are between 2.43 and 2.89. The distributions were found to approach normality.

Within the home population the potency of occupation is felt in the differential influence it exerts on the extent of participation in leisure-time pursuits. The difference in mean extent of participation between the professional-managerial and service occupations is significant ($p = .01$). Significant beyond the .01 level are the differences in mean extent of participation of the professional-managerial versus the housewife, the mechanical versus the service, and the professional-managerial-mechanical versus the clerical-service-housewife groups. Both the Protestant and the Jewish groups had larger means than the Catholic group. These differences are significant at the .001 and .01 levels, respectively. The mean extent for participation of the

TABLE 1

MEANS FOR EXTENT OF ACTIVITY PARTICIPATION AND EXTENT OF INTEREST EXPRESSED FOR 108 HOME AND 108 CENTER AGED PERSONS: BREAKDOWN BY SOCIO-ECONOMIC AND PSYCHOLOGICAL CHARACTERISTICS

Characteristic	Population Number			Activities				Interests			
				Home		Center		Home		Center	
	Total*	Home	Center	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Sex											
Female	113	53	60	7.72	2.89	10.20	3.51	5.60	3.14	5.37	3.42
Male	103	55	48	8.45	2.71	9.48	2.96	5.00	2.82	4.58	3.35
Age											
Young (65-74)	107	38	69	8.21	2.84	10.12	3.39	6.13	2.87	5.13	3.27
Old (75+)	103	70	33	8.03	2.82	9.48	3.26	4.84	2.96	4.33	2.99
Education											
High (College & High School)	69	33	36	9.27	3.21	10.72	3.77	5.64	2.80	5.44	3.92
Low (Grammar or Less)	147	75	72	7.57	2.46	9.46	2.96	5.15	2.94	4.81	3.11
Religion											
Protestant	95	53	42	8.91	3.04	10.38	3.22	5.45	3.50	4.40	3.21
Catholic	64	28	36	6.53	2.19	9.69	3.71	5.50	2.54	5.94	3.70
Jewish	53	27	26	8.11	2.23	9.42	2.36	4.78	2.18	4.85	3.12
Race											
White	180	95	85	8.20	2.86	9.85	3.04	4.88	2.73	4.78	3.12
Negro	36	13	23	7.31	2.43	10.61	3.92	8.31	3.09	5.91	4.20
Economic Identification											
Wealthy-Middle	91	52	39	8.62	3.14	9.72	3.35	4.58	2.82	3.77	2.94
Poor	79	41	38	7.44	2.63	9.42	3.07	5.83	3.14	6.11	3.86
Relief	46	15	31	8.07	2.84	10.65	3.38	6.33	2.50	5.26	2.77
Birthplace											
United States	115	57	58	8.18	2.95	10.19	3.49	5.61	3.14	4.79	3.24
Western Europe†	59	26	33	7.85	2.85	9.58	2.96	5.23	3.32	5.27	3.73
Eastern Europe	42	25	17	8.16	2.48	9.41	3.20	4.64	2.02	5.29	3.34
Employment Wanted											
Full-time	29	17	12	7.36	2.20	10.25	4.34	6.88	2.74	5.33	4.03
Part-time	42	21	21	8.71	2.39	10.00	2.65	5.76	2.96	6.00	2.94
Occasional	42	19	23	7.68	3.06	9.57	3.46	5.74	2.18	6.13	3.86
None	103	51	52	8.24	3.01	9.89	3.18	4.41	3.06	4.06	2.91

TABLE 1 (*continued*)

Characteristic	Population			Activities				Interests			
	Number			Home		Center		Home		Center	
	Total*	Home	Center	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Marital Status											
Widowed	145	73	72	8.03	2.66	10.58	3.07	5.05	2.99	4.96	3.39
Single	40	22	18	8.09	3.14	8.72	4.15	6.00	2.73	5.00	2.81
Residence											
Own Home	48	—	48	—	—	10.23	3.02	—	—	4.58	3.42
Boarding	51	—	51	—	—	9.55	3.10	—	—	5.72	3.27
Occupation											
Professional–Technical–Managerial	55	24	31	9.21	1.93	10.00	3.19	5.12	2.73	4.97	3.18
Clerical–Sales	24	12	12	7.75	3.49	9.08	2.90	4.75	2.49	4.00	2.41
Mechanical	61	36	25	8.39	3.18	10.28	3.57	5.67	3.27	5.48	3.77
Service	35	11	24	6.45	1.33	8.79	2.53	6.18	3.04	4.62	3.58
Housewife	41	25	16	7.48	2.60	11.25	3.71	4.80	2.87	5.75	3.38
Professional–Technical–Managerial–Mechanical	116	60	56	—	—	10.37	3.48				
Clerical–Sales–Service–Housewife	100	48	52	—	—	8.89	2.66				
Professional–Technical–Managerial–Mechanical–Housewife	157	85	72	8.71	2.77	—	—				
Clerical–Sales–Service	59	23	36	7.31	2.69	—	—				

*Total not equal to 216 where small subgroups not treated statistically.
†Includes 10 cases from Canada and West Indies.

the high school and college people exceeded the mean for the grammar school and less educated people and the difference is significant at the .01 level. The wealthy-middle class group surpassed the poor class group in the average extent of participation ($p = .05$).

b. Extent of activities for the center population. The means for extent of participation in leisure-time activities of the center population are larger than for the home population; they range from 11.25 for the housewife group to 8.72 for the single group. Table 1 also presents the other center groups displaying a high average participation: Negro, relief, and high education. Low are the service and clerical-sales aggregates. The standard deviations vary from 2.36 to 4.34 but most are less than 3.40. The variability within the groups is thus seen to be greater than for the home population. The distributions were found to approach normality.

Only two t ratios are significant for the differences in the mean extent of activities of the center subgroups; the professional-managerial-mechanical-housewife aggregate is significantly different from the clerical-sales-service group at the .01 level. The housewife group mean surpassed the service group mean and is significant beyond the .05 level.

c. Significant differences between the matched subgroups. All differences in mean extent of participation in activities show the center groups to be higher. Significant t ratios between the matched subgroups of the home and center populations appear for the female, 65 to 74 years old, low education, service, housewife, Catholic, white, Negro, poor, United States, widowed, and non-employment-seeking groups at the .01 level. At the .001 and .01 levels are the relief and Western Europe groups, respectively. The over 75 years old, mechanical, Protestant, and Jewish groups differ in mean extent of participation at the .05 level.

d. Extent of interests for the home population. The mean extent of interest expressed by the home population, in Table 1, goes from 4.41 for the subjects not wishing to work to 6.88 for those desiring full-time employment. Far beyond is the average of the Negro group at 8.31. Other high aggregates are the persons who said they were relief recipients and the persons formerly occupied in the service trades. The subjects who identified with the wealthy-middle class and the subjects who came from Eastern Europe presented low averages for the extent of interest expressed. The standard deviations run mostly from 2.02 to 3.14; two go beyond this, 3.27 and 3.50, and both are related to the higher means. It is clear that the variability within the groups is wide. The distribution of incidence at the various levels, for the groups, approximates normality.

Fewer significant t ratios appear for differences in mean extent of interest expressed than for differences in mean extent of participation in activities, and those which appear are less significant. Greater averages occur for Negro over white, full-time over non-employment-seeking, part-time and occasional over non-employment-seeking, relief over wealthy-middle class, and poor over wealthy-middle class aggregates and are significant, the first two at $p = .001$, the others at $p = .05$.

e. Extent of interests for the center population. The mean extent of interest expressed by the center groups, in Table 1, spreads from 6.13 for the subjects who desired occasional employment to 3.77 for the subjects who identified with the wealthy-middle class. Such other subgroups as the Negro, poor, and the part-time employment-seeking also had high averages, and the clerical-sales and the non-employment-seeking subgroups had low averages. The distribution of the scores at the various levels, for the subgroups, approaches normality; however, the variability is wide. Most of the sigmas are between 2.91 and 3.86.

The difference in mean extent of interest expressed by the poor and wealthy-middle class groups is significant at the .001 level. The difference between the averages of the part-time employment-seeking cluster and the non-employment-seeking cluster is significant ($p = .01$). Significant at the .05 level is the difference in means of the relief versus wealthy-middle class and occasional-employment-seeking versus the non-employment-seeking groups. Those who considered themselves of lower status economically and those who felt the urge to work surpassed their polar groups in their breadth of interest.

f. Significant differences between the matched subgroups. No t ratio of significance was obtained for the differences in extent of interest expressed between the matched subgroups of the home and center populations (Table 1).

2. *Interrelationships Among the Characteristics of the Home and Center Populations*

Since a corrected contingency coefficient of .50 was used as the critical point, age, sex, and education were selected for further study of their association with the nature of the activities and interests of the home group. The other characteristics either did not have sufficient numbers in the subgroups to treat statistically or correlated so highly with the variables selected that nothing new would be contributed. Age, sex, education, religion, economic identification, and employment wanted were considered sufficiently independent of the other variables to treat further in relation to the nature of the activities and interests of the center subjects.

3. *Nature of Activities and Interests*

The items are grouped according to major headings in the tables.

a. Nature of activities of the home population. These classes of activity were participated in often by large numbers of the different subgroups of the home in the following order: "other sedentary" (writing letters, talking, looking out window, lounging), radio listening, reading, social, and religious. Important in Table 2 are the high incidence of movie attendance of the young group, the frequency of participation in outdoor activities of the males, and the one hundred per cent engagement in radio listening of the high education group. Consistently low, regardless of the sex, age, or education of the home subjects were weaving, graphic art, and civic and other organizational undertakings. Creative writing was infrequent among the male and less educated persons.

The only sex difference, which is acceptable beyond the .01 level, is for sports. Movie attendance and religious practices are the items which significantly differentiate between the young and old groups, the first at $p = .001$ and the second at $p = .01$. The force of education is displayed in the differences between the high and low schooling groups on solitary and social games, graphic art, writing, reading, radio, collecting, and theatre classes of activity. All are significant ($p \geqq .01$).

b. Nature of activities of the center population. Table 2 reveals few classes of activity with a low incidence of participation for the subgroups of the center population. Active sports and weaving were low for all and civic activity for the relief, Jewish, low education, and old groups. Serious study was rarely found among the low education and non-employment-seeking aggregates. "Other sedentary," reading, "other active," radio, religious, and social classes, in that order, were participated in often. Prominent for the female, old, low education, wealthy-middle class, Protestant, and employment-seeking groups was the social class of activities. All but the Protestants and the males placed "other active" (window shopping, auto riding, visiting beach or park) high in incidence. Social games occurred more often among the men, the young, those on relief, and those seeking employment.

Whereas more males engaged in solitary games than did women, they were outnumbered in social, "other active," domestic, and weaving classes of

TABLE 2

PER CENT OF HOME AND CENTER POPULATIONS PARTICIPATING IN VARIOUS CLASSES OF ACTIVITIES: BREAKDOWN BY CHARACTERISTICS

	Total		Home*						Center*									Employment Wanted				
	Residence		Sex		Age		Education		Sex		Age		Education		Economic					Religion		
Class	Home	Center	F	M	Y	O	H	L	F	M	Y	O	H	L	W-M	P	R	F-P-O	N	Pr.	C	J
Sports	13	5	4	22	8	16	18	11	5	4	6	3	6	4	8	5	0	4	6	7	0	8
Outdoor	56	67	45	66	58	54	58	55	61	73	65	70	61	69	62	53	68	72	62	79	64	50
Games (solo)	23	8	28	18	26	21	48	12	3	15	7	12	11	7	8	8	10	7	10	5	17	4
Games (social)	42	61	40	44	45	40	61	33	57	67	60	67	72	55	51	50	87	70	52	57	64	65
Social	72	69	70	75	61	79	61	77	77	58	65	70	56	75	84	66	55	72	65	84	64	54
Civic and Organization	3	9	4	2	3	3	6	1	10	8	9	3	20	4	10	11	6	11	8	10	14	0
Music	17	45	21	13	21	14	18	16	53	36	48	40	39	49	39	45	55	45	46	55	42	35
Graphic Arts	5	27	4	5	0	7	15	0	25	29	28	27	31	25	21	34	26	27	27	36	22	15
Dramatics	7	27	4	11	3	10	15	4	18	38	32	12	39	21	31	26	23	30	23	17	31	31
Writing	5	14	8	2	5	4	15	0	8	21	17	9	28	7	15	8	19	20	8	12	19	8
Crafts	6	13	8	5	13	3	3	8	18	6	16	9	14	13	8	16	16	14	12	19	8	12
Sewing	31	40	55	7	34	29	39	27	68	4	44	33	45	38	39	37	45	38	42	57	31	31
Weaving	4	6	4	4	8	1	0	5	12	0	9	3	8	6	3	3	16	9	4	12	3	4
Reading	74	78	74	75	66	79	88	68	77	80	76	79	95	70	82	74	78	80	75	74	75	88
Study	12	10	13	11	13	11	18	9	7	15	10	9	20	6	5	16	10	18	2	14	8	8
Museum	20	51	9	31	24	19	27	17	42	63	55	46	70	42	64	40	48	48	54	48	39	69
Domestic	15	54	15	15	11	17	24	11	65	40	60	43	47	57	62	55	42	55	52	64	56	39
Sport Watching	9	19	2	16	5	11	15	7	13	25	19	21	28	14	18	13	26	21	15	21	19	15
Theatre	32	31	26	38	29	34	12	41	30	31	26	36	45	24	36	24	32	32	29	31	36	23
Movies	54	42	49	58	79	40	58	52	42	42	47	33	59	33	49	47	29	38	46	33	39	62
Radio	82	72	79	86	87	80	100	75	78	65	76	64	81	68	80	71	65	73	71	74	70	85
Other Active	42	74	38	46	42	42	48	39	73	35	77	73	70	77	77	76	68	73	75	69	75	85
Other Sedentary	85	88	81	89	90	83	91	83	92	84	84	97	92	86	87	84	93	84	92	83	83	100
Collecting	18	13	15	20	11	21	33	11	13	13	13	12	14	13	15	11	13	16	10	29	6	0
Religious	71	69	76	67	84	64	70	72	78	58	67	76	61	74	64	68	78	66	73	83	81	42
Job	12	12	0	11	3	7	6	5	13	10	13	10	18	10	5	18	13	23	0	14	11	12

*Abbreviations: F = female, M = male, Y = young, O = old, H = high, L = low, W-M = wealthy and middle class, P = poor, R = relief, F-P-O = full-time and part-time and occasional, N = none, Pr = Protestant, C = Catholic, J = Jewish.

items ($p \geqq .05$). The young participated in greater numbers in dramatics and the old participated in greater numbers in "other sedentary" undertakings; for both differences $p = .01$. The high education group engaged in greater proportions than did their polar group in civic, creative writing, reading, museum visiting, movie, and theatre attendance classes of leisure. All the differences are significant at or beyond the .01 level but the last, which is significant at the .05 level. Only in museum and library visiting did a clear difference between the wealthy-middle class group and the poor group appear ($p = .05$). The wealthy-middle class group differed beyond the .01 level from the relief group in the involvement with social activity and social games. The wealthy-middle class out-stripped the relief group in social pursuits but the reverse occurred for social games. The relief clients differed also with the poor group at a significant level ($p = .001$) since so large a percentage of its members engaged in such games as cards and checkers. In serious study, the subjects who mentioned interest in employment were proportionately more active than those not wishing employment ($p = .05$). The Protestants surpassed both the Jews and Catholics in collecting, sewing, and social classes of items, and the Jews in outdoor, civic, graphic arts, domestic, and religious types of pursuits. All these differences are significant at least at the .05 level and the differences in the collecting and religious items are acceptable at the .01 level. The Jewish group assumed greater numbers and surpassed both the Catholic and Protestant groups in "other sedentary" activities, and the Protestant groups in movie attendance and the Catholic group in museum attendance. These differences are significant at the .01 level. The Catholic group participated in greater numbers in civic and religious endeavors than did the Jewish group, and the differences between them are significant at the .01 and .001 levels, respectively.

c. Significant differences between the matched subgroups. The males differed in their manifestations only in active sports, radio listening, and creative writing activities. All are significant between the .01 and .001 levels; the center men surpassed only on writing. The females differed on three items, solitary games, domestic chores, and "other active" pursuits; all disparities exceeded the .001 level. Among the young, the home residents tended more toward solitary games and attendance at movies than did their center parallels, and the center young exceeded the home young in the music, graphic art, dramatic, museum, domestic, spectator sport, and "other active" classes ($p = .01$). The center young are more involved in artistic and active pursuits than the home aggregate ($p = .001$). For the old the center group surpassed the home group whenever a difference occurred, and these are all significant at the .01 level: social games, musical activity, graphic art, visiting museums and libraries, domestic chores, "other sedentary," and "other active." The high education subgroup of the homes had more subjects participating in solitary games and collecting items than did the centers. The high education center subjects exceeded in the music, dramatic, museum, domestic, and theatre classes of activity. The center low education subjects had a higher proportion attending the theatre and movies, and the home low education subjects had a higher proportion participating in domestic chores, dramatic endeavors, graphic art, social games, musical activities, and museum programs. The differences mentioned for the educational subgroups are all significant at least at the .05 level; actually most go beyond.

d. Nature of interests of the home population. The "other active," outdoor, social, and theatre classes of interest were chosen, in that rank order, by the total home population (Table 3). The low education, old, and male subjects chose "other active" items more frequently than any other. The highest incidence for females occurred in the social class, for the young in the outdoor class, and the high education persons in the theatre class of pursuits. The men were most desirous of active ventures. Consistently low for all subgroups were solitary games, and low for all but the female and high education groups was the interest in serious study. Civic activity was low and civic interest also was low for the female, low education, and old subgroups of the home population. Quite infrequent for the young and the low education subgroups were the choices of travel as an interest.

Within the homes the males were more inclined than the females to wish for a job and craft activities ($p = .001$). The females were also outnumbered in the desire to watch sporting events, and this difference is acceptable at the .01 level. More females than males expressed interest in solitary game, social, and radio classes of engagement ($p = .05$). The males were also surpassed in domestic, sewing, theatre, and movie classes ($p = .01$). The young home aggregation exceeded the old in the desire to be involved in domestic chores and outdoor ventures ($p = .05$). They were also more concerned with obtaining a job ($p = .01$). The old group exceeded the young in the wish to attend the movies ($p = .01$). The persons with low education presented greater numbers who want to spend their time in "other sedentary" or domestic pursuits than did the persons with high education who displayed larger proportions who want to travel, attend the theatre, and do creative writing. The difference on the theatre is significant at the

TABLE 3
Per Cent of Home and Center Population Expressing Interest in Various Classes of Activities: Breakdown by Characteristics

	Total		Home*						Center*													
	Residence		Sex		Age		Education		Sex		Age		Education		Economic			Employment Wanted		Religion		
Class	Home	Center	F	M	Y	O	H	L	F	M	Y	O	H	L	W-M	P	R	F-P-O	N	Pr.	C	J
orts	19	11	15	24	29	14	30	15	10	12	15	6	17	8	8	13	13	16	6	10	17	4
utdoor	55	68	60	49	69	47	52	56	68	67	76	58	70	67	54	74	78	72	64	69	72	65
ames (solo)	4	4	8	0	8	1	0	5	2	6	3	3	3	4	0	5	6	5	2	5	6	0
ames (social)	19	7	19	18	21	17	18	19	5	10	7	6	6	8	0	16	6	14	0	7	8	8
cial	52	44	62	42	53	52	55	51	45	42	49	36	50	40	38	42	52	45	42	40	44	50
vic and Organization	8	10	6	11	13	6	15	5	10	10	10	3	14	8	8	18	3	14	6	12	8	8
usic	17	15	11	22	21	14	15	17	20	8	15	9	17	14	10	24	10	20	10	12	22	12
aphic Art	12	16	9	15	11	13	9	13	18	12	16	12	20	14	15	16	16	21	10	19	17	12
amatics	12	9	9	15	11	13	21	8	8	10	10	6	17	6	13	11	3	11	8	7	8	15
riting	9	9	9	9	5	11	24	3	7	12	9	2	8	10	5	18	3	18	0	7	14	4
afts	21	21	6	36	18	23	12	25	22	21	23	6	28	18	18	21	26	30	12	19	22	19
ving	13	10	25	2	11	14	12	13	18	0	12	0	6	13	8	13	10	13	8	14	11	4
eaving	11	10	13	9	13	10	6	13	17	2	9	6	17	7	3	18	10	16	4	14	6	12
ading	10	8	11	9	11	10	12	9	10	6	9	9	8	8	5	11	10	13	4	7	8	12
dy	6	6	9	2	5	6	9	4	12	0	4	3	14	3	5	11	3	11	4	7	3	12
seum	44	31	40	47	42	44	42	44	38	21	12	33	36	28	28	37	26	32	29	33	28	31
nestic	20	28	28	13	32	14	9	25	32	23	30	21	33	25	28	32	23	38	17	10	36	42
rt Watching	27	26	17	36	37	21	24	28	22	31	28	27	25	26	21	37	19	29	23	26	25	27
eatre	42	53	55	29	40	43	70	29	58	46	54	52	53	53	46	58	55	57	48	48	58	54
vies	28	40	40	16	13	36	27	28	40	40	39	46	33	43	36	32	55	45	35	40	47	31
lio	7	10	13	2	3	10	9	7	12	8	9	15	8	11	3	16	13	11	10	7	19	4
er Active	58	51	55	62	61	57	48	63	62	38	47	58	50	51	41	58	55	50	52	40	67	54
er Sedentary	10	8	13	7	8	11	3	13	10	6	9	6	11	7	0	13	13	11	6	7	17	0
lecting	12	2	15	9	8	14	15	11	0	4	1	3	3	1	0	3	3	2	2	0	6	0
igious	14	5	15	13	13	14	12	15	3	6	6	3	14	0	0	13	0	7	2	2	11	0
	20	17	8	33	34	13	15	23	13	21	20	12	28	11	13	24	13	32	0	12	14	27
avel	8	14	6	11	5	10	18	4	15	12	9	27	20	11	13	11	23	12	17	17	17	8

*Abbreviations: F = female, M = male, Y = young, O = old, H = high, L = Low, W-M = wealthy and middle class, P = poor, R = relief, -P-O = full-time and part-time and occasional, N = none, Pr = Protestant, C = Catholic, J = Jewish.

.001 level, on the "other sedentary" and travel items at the .05 level, and on the domestic and writing items beyond the .05 level of confidence.

e. Nature of interests of the center population. The outdoor, theatre, "other active," and social classes of interest were chosen, in that rank order, by the total center population (see Table 3). The social type of activity was chosen by fewer persons in the female, old, and low education center categories than in the home counterparts. Whereas the museum class of items figured prominently for the home subgroups, the movie order usurped its position for such center subgroups as female, male, old, and low education. Consistently low in incidence were the solitary game and collecting orders of activities, and low in all but the high education, Catholic, and poor subgroups was the interest in religious activities. Few persons outside of those in the female, high education, Jewish, Protestant, employment-seeking, and poor subgroups displayed a desire to devote time to serious study. No person in the non-employment-seeking subgroup said he wanted a job.

Reference to significant differences between the high and low education subgroups reveals but one, based on the larger percentage of the high education subgroup wanting a job ($p = .05$). The female part of the centers exceeded the male segment in the sewing, weaving, study, and "other active" classes of interest ($p = .01$). More old persons than young wished to get to the museums and libraries but more young persons than old desired to do craft work and sewing ($p = .01$). More of the old than of the young expressed an interest in traveling ($p = .05$). Most significant, at the .001 level, is the difference between persons desiring some kind of employment and those not desiring any employment. The former clearly expressed their interest in working by mentioning this more than did the others. The pervasiveness of wanting a job allowed for no other differences of any consequence between any subgroups. The persons desiring employment surpassed those not seeking employment at every other point of difference; for social games and writing the differences are significant at the .001 level, for crafts and domestic chores at the .01 level and for weaving at the .05 level. At approximately the .01 level the differences between the poor and the wealthy-middle class subgroups are significant. The poor surpassed the wealthy-middle class in the social game, weaving, "other sedentary," and religious classes of interests. The wealthy-middle class was also exceeded by the relief class in the outdoor and "other sedentary" groups of items, and the differences in the percentages expressing interest in these areas are significant at the .05 level. The Protestants had fewer persons than either the Jews or the Catholics expressing interest in domestic deeds, and these differences are critical at the .01 level. The Catholic center subgroup outstripped the Jewish center subgroup in "other sedentary" and the Protestant center subgroup in "other active" classes of items ($p = .01$). The Catholics surpassed the Jews in the number yearning for religious activities ($p = .05$).

f. Significant differences between the matched subgroups. It can be seen that more center females expressed interest in craft work but more home females displayed a desire for social games, religious practices, and collecting things ($p = .01$). The center males exceeded in movie attendance but the home males surpassed in the music, museum, and "other active" classes of interest. The difference in music is significant at the .05 level and the others beyond the .01 level. The differences in the writing, religious, collecting, and travel classes are significant at the .05 level and in the craft and sewing classes of items at the .01 level for the old home and old center aggregates. The home subgroup had larger numbers for each class of interest. Significant at the .01 level are the differences in interest expressed in museum visiting and movie attending by the young subjects. Those in the homes exceeded in the former and those in the centers in the latter. The low education center subgroup was more desirous of attending the theatre than was the low education home subgroup which was more interested in the museum, religious, and collecting types of items ($p \geq .05$). No differences between the two high educational subgroups appeared.

D. Summary and Conclusions

Senescents varying in several psychological and socio-economic characteristics were interviewed, individually, with respect to their leisure-time activities and interests. This paper presents part of the findings, as follows:

1. The home and center populations differ more in the extent and nature of activities than interests, where few significant differences occurred. Since desires are less influenced by available opportunities than are actual undertakings, those differences found may be more situational than personal.

2. Further reinforcing the likelihood that environmental opportunities are crucial in determining the senescent's way of life, at least his leisure, is the indication that even those persons who have suffered privation or limited breadth of experience, are more active in the centers than are their counterparts in the homes which are usually more restricting physically and psychologically. The home versus center was found to be the most influential variable upon activities and interests; it is considered the manifest difference in social mobility, personal freedom, and available opportunities.

Persons of greater social mobility in the centers were more active than other members.

3. Persons of higher socio-economic status (high education, professional and managerial occupations, identification with the wealthy or middle class, often the Protestant) are more dependent upon themselves, whereas the persons of lower socio-economic status (low education, service occupations, identification with the poor or relief class, Negro, occasionally the Catholic) are more dependent upon the environment and upon others for leisure-time gratification.

4. The occupation, economic identification, age, education, religion, and home versus center factors are related to the extent of activities, with the last exhibiting the greatest influence. Race, economic identification, and desire for employment are related to the extent of interests, with the last showing the strongest effect.

5. Home versus center, education, sex, and age, in that order, are associated with the nature of activities participated in often and the nature of the pursuits desired. For the centers religion is associated with the nature of activities and desire for employment with the nature of interests.

6. The activities chosen are inclined to be passive and the interests active.

7. The psychological and socio-economic characteristics of the subjects tend to be selective in their relationships with the extent and nature of leisure-time items: (*a*) Most significant is the greater extent of activities in the centers and interests in the homes. (*b*) Higher socio-economic groups have greater breadth of activity and lower socio-economic groups greater breadth of interest. (*c*) Persons of greater social mobility mentioned more activities and persons of limited opportunity listed more interests. (*d*) Those not desiring employment have minimal activities and interests, and those desiring employment display the converse. (*e*) Males are more active in outdoor pursuits and more desirous of a job. (*f*) The female and old groups engage in religious functions. (*g*) Female and low education groups select domestic chores. (*h*) The young (65 to 74 years) are more active and desirous of activity than the old (75 years plus). The old in the centers reveal more activity and sociability than their home counterparts. (*i*) The centers, more than the homes, engage in active and cultural pursuits. (*j*) The homes are desirous of more religious and social undertakings. (*k*) High education is related to interest in civic and cultural items, low education to social pursuits.

8. Participated in by the greatest number of persons in homes and centers is the "other sedentary" (writing letters, talking to people, looking out

the window, and lounging), radio (all radio and phonograph programs), reading (books, newspapers, and magazines), religious (devout and social aspects), and social (visiting, being visited, parties) classes of activity. The "other active" class (window shopping, auto riding for pleasure, going to beach or park) is also favored by the centers.

9. The outdoor (walking, gardening, fishing), "other active," theatre (legitimate drama and recitals), and social classes of activity are desired by the greatest number of both home and center subjects. Also important for the homes is the interest in visiting libraries and museums, and for the centers is the interest in attending the movies.

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REVIEWED BY NATHAN ISRAELI

A. FIRST TWO YEARS OF LIFE

This book is a translation of *La Construction du Réel chez l'Enfant* (18) published in 1937. It represents views of Piaget as of that time. During that year a Harvard Tercentenary Conference included a paper of his (19) which briefly summarized the principal outcomes of his work. In both places, Piaget introduced the mathematical group into analysis of child development.

Experimentation reported in this book can be traced back to 1925 when observations were reported of his daughter Jacqueline in connection with a paper on causality (13). Those observations were taken from *La Naissance de l'Intelligence* which was then under preparation with Mrs. V. J. Piaget. That book appeared in 1936 as the first in a sequence of three books (17). The other two books are *La Construction du Réel chez l'Enfant* and *La Formation du Symbole chez l'Enfant* (21). Translations of those books were published between 1951 and 1954 (23, 24). That sequence covers development during the first two years and is based exclusively on day to day observation of the author's three children, Jacqueline, Lucienne, and Laurent. This exploration of the earlier life period was carried out at the time that he was directing studies of older age-level children.

B. SENSORIMOTOR INTELLIGENCE

Frequent cross-references are made in this book to *The Origins of Intelligence* (24), the first book of the sequence. That book describes the following six consecutive stages in the development of sensorimotor intelligence during the first two years: (*a*) reflex schemata; (*b*) primary circular reactions: reproduction with repetition of successful movements which is the mechanism for reflex modification and formation of associations and habits; (*c*) secondary circular reactions: an application of familiar means to new situations; (*d*) coördination of secondary reactions with appearance of tertiary circular reactions; (*e*) establishment of tertiary circular reactions: discovery or invention of means through active experimentation; and (*f*) representation of interiorized behavior, partially symbolic in nature, and depending on detachment of images from perception within the immediate situation, with a mental combination of schemata. Development is explained by changing nature of assimilation and accommodation which work at first in opposite directions, then become differentiated, and finally reach an equilibrium. That theory excludes neither hereditary schemata nor environment. It includes during early stages random activity, trial and error, grouping, association, and conditioning. During the later stages, it includes a dominance of structures.

C. CONSTRUCTION OF REALITY

The six development stages of sensorimotor intelligence are applied in this book to follow the construction of concepts of object, space, causality, and time. Those concepts are developed concurrently. However, object conservation is regarded as the first invariant to be achieved. Development of those concepts is outlined here.

1. *Object*

At the beginning, perceptual images are mobile and plastic. They have neither continuity nor permanence. During the first two stages, children become aware of the disappearance of objects and try to find lost objects. During the third stage an object takes on limited permanence. A search is made for an object within the perceptual field. At Stage 4, a search for vanishing objects is made at the position where they were found the first time. Shape constancy and size constancy are then discovered. At Stage 5, the child learns to build up sequential perceptions and to group displacements of objects. An object is seen to have its own trajectory. A search is now made for a vanishing object at the point where it last disappeared. At the sixth stage, representation of invisible displacements is the key to construction of objects outside the visual field.

2. *Space*

At the first two stages, practical groups of operations that are repetitive are formed from perceptual clusters. Spaces vary with sense modality and have very short duration: auditory space, visual space, tactile space, kinesthetic space, gustatory space, and postural space are unrelated. These practical space groups are coördinated at the third stage. Subjective space groups are now formed. Prehension and sight are coördinated. Planes of depth are arranged in order and depth perception is related to the body. Moving objects appear to be extensions of the child's own activity. At the fourth stage, with application of familiar means to new situations, the child becomes aware of increasing distance and grasps at objects beyond reach. Groups depend on the child's own movements. At the fifth stage, objective space groups are formed. The trajectory of a moving object is autonomous. Groups of movements of rotation and translation of objects and groups of displacements of objects within the perceptual field are formed. The child is able to determine the position and the displacement of his body by reference to objects. At the sixth stage, representative space groups are formed. External images are intercoördinated. Objects change position behind one another at different plane depths. The child now represents space relations between objects, displacements, movements and position of his body and of objects.

3. *Causality*

At first, personal action, personal feelings, and the outside world are not differentiated and after a while two different views of action, phenomenal cause and efficacy, are characteristic, from the observer's viewpoint, of the child's behavior. Events are looked upon as if controlled by the child's own movements and are related to his activity. Desires are sufficient to cause results even without any action for their realization (*efficacy*). Gestures have efficacy. Magic-phenomenal procedures are used to control events. A child clasps his hands or shakes his head to cause an external activity to be repeated or continued. During Stages 4 and 5 the child distinguishes between efficacy and phenomenalism. He feels that his intentions, desires, and efforts have power over his body. He notices that relationships among objects are independent of his action (*phenomenalism*). In Stage 4, causality becomes partly objectified as when a child notices contacts between objects. It also becomes partly spatialized as in observation of intermediate steps between cause and effect. Things are set in motion to produce certain effects. Schemata are coördinated at the fifth stage. Causal series are then detached from the child's action with an awareness of his own body movements as displacements producing effects that are perceptible. At the sixth stage, representative causality involves anticipation and deduction.

4. *Time*

During the first two stages, the child's activity dominates his limited experience of duration. Practical time series are formed. At the third stage, a subjective time series is formed as in localization in time, or in a sequential arrangement of events in which things are acted upon by the child. At the fourth stage, he now becomes aware of before and after as he groups displacements of objects. An objective time series is formed of events having no connection with his action. At Stage 5, the objective time series is well established. The perceptual field is ordered but without any distant past memories. In the sixth stage, representative time series are established. An objective series extends events of the present perceptual field into the past and future.

D. Group Theory

This book is Piaget's first to apply the mathematical group theory. Here, the application is somewhat limited as to object grouping or to grouping of displacements in a formation of practical, subjective, objective, and representative space groups. Time, during this early period, is not regarded as coming under the operations of the group. It is assumed that the child's world is still irreversible. Series and sequences do not have the properties of groups: that is why time series instead of time groups are now formed.

1. *Group Operations*

Groups are characterized principally here by a reversibility of operations. Reversibility is a return to the starting points. It includes two complimentary operations, the inverse and the reciprocal (24). In this book, Piaget also includes group properties such as additiveness as in summing two displacements. Although not aware of it, the child is doing that when in walking in a garden he takes Pathways *PB* and *BA* in going from *P* to *A* and returns by going directly across the grass from *A* to *P*. In another instance, additiveness is indicated by the child's behavior when he goes from Position *P* to Position *Q* to Position *R* and to Position *S* and then returns directly from *S* to *P*. Reference is also made in this book to the identity operation and to a multiplicative operation, as when the product of two relations is a relation. Elsewhere this study was interpreted as showing associativity in connection with possibility of detour.

Requirements for the grouping of displacements are that child should relate displaced objects to one another or to some landmark, represent his own displacements, and differentiate between his movements and those of objects.

2. *Reversibility*

Assuming that Piaget did not apply explicitly the theory of mathematical groups before 1937 to his child studies, nevertheless, it can be shown that implicitly his interests along these lines go back to the commencement of his developmental studies. In 1921, he alluded to a "series of forms, grouping themselves in a hierarchy of psychological difficulty" (11). Reversibility of operations was mentioned quite early: in the development of reasoning a trend was shown from irreversibility to reversibility of operations (15). That is a sign that he was then implicitly trying to apply certain aspects of group theory. He regards reversibility as the most important aspect of grouping in logic and also as describing operations of intelligence and reasoning (22). This then shows again that Piaget was interested early in his career in application of group theory to psychology.

3. *Poincaré*

Piaget applied here Poincaré's discussion of displacement groups in relation to an observer's movements and muscular sensations, corrections of displacements, and intermediaries (26). It may also be that his convictions as to the value of group theory for psychology are derived, in part, from Poincaré's belief as to a relation between the mathematical group and the mind. This is perhaps somewhat analogous to isomorphism in gestalt theory.

4. *Lewin and Piaget*

An interesting comparison can now be made between Piaget and Lewin. Lewin accounted for his own interest in topological psychology at an early date, which he did not specify, when he was thinking about applying point set theory and topology to psychology. His interests in mathematics are reflected in a different field in 1922 (6). He introduced vectors into psychology later on (7) and his major work on topological psychology appeared in 1936. Piaget's 1941 paper (20) constitutes a systematic basis for a topological child psychology. Both had common interests also in other fields. Thus, Lewin was interested in genetic problems of physics and biology and also in the theory of knowledge. However, citations to one another do not reflect any contact with or consideration of topology or group theory. Lewin operated within the framework of gestalt theory and Piaget emphasizes genetic development of that theory's constancies, forms, relations, and structures. Interaction between these two topological psychologists would certainly have been most profitable. As it is, Piaget's interests in topology and its applications to psychology, according to our discussion above, most probably originated independently. The results of Piaget's work intersect with Lewin's topological psychology at certain points but not at others.

E. ASSIMILATION AND ACCOMMODATION

Assimilation is a concept which can be found in almost any of Piaget's publications. Accommodation is a more recent concept. At one time, imitation was paired with assimilation. Earlier views of assimilation are reflected below: (*a*) In reflection, completely strange judgments are assimilated, in trying to understand them (11). (*b*) Judgment is an adaptation to the outside world; new elements are integrated into a system of acquired elements (12). (*c*) Assimilation is a fusion of a new object and a schema. At first, assimilation and imitation work in opposite directions and then become complementary (15). (*d*) New movements are partly incorporated into schemata (16).

In *Origins of Intelligence* and in this book, assimilation and accommodation are development mechanisms forming circular reactions. Reproductive assimilation is instrumental in reproduction of successful movement in primary circular reactions. Generalized assimilation extends reflex schemata to new objects in secondary reactions. Accommodation combines schemata in an adjustment to new circumstances in the tertiary reactions. Assimilation is an integration and incorporation of objects, elements, movements, signals into the child's activity or into his system of reaction schemata. Accommodation is an adjustment of those schemata when meeting situations that vary or have special requirements. Assimilation is an internal orientation and leads to deduction. Accommodation is an external orientation and encourages a manipulation of objects. It leads to experimentation. The function of assimilation is an acquisition of techniques and skills. It is dominant in conventional behavior but not in unconventional behavior.

These concepts require further clarification.

F. CAUSALITY: EFFICACY AND PHENOMENALISM

In his earlier studies of this subject, Piaget developed a systematic development account (13, 16). In this book, his previous discussion of efficacy and phenomenalism as two aspects of causal sequences remains unmodified. He views phenomenalism as a theory of anything with anything but without any dependence upon sentiment as originating with Hume. Also, he views efficacy to be a theory of association based on feelings of muscular effort which originated with Maine de Biran, and drew upon Brunschvicg (5) for support. Recently, Piaget reviewed again this subject taking a middle course between those views. Causality originates as a relation between action and things and results from "organization of experience as a function of schemata of action" (22).

In a recent experimental study of perception of causality (9), Michotte discusses the work of Piaget and supports the contrast between efficacy and phenomenalism as two different explanations of causal sequences. Michotte follows him in going back to Hume and Maine de Biran. Like Piaget, he also considers Brunschvicg's treatment of their views.

G. Developmental Theory

One of Piaget's tasks upon completion of this study of the first two years of life is to establish continuity and coherence between early development and later development. By the end of the development of the sensorimotor level of intelligence, a child achieves representation, invention, deduction, use of signs and symbols, and a substantial reduction of egocentrism. At the next level, that of practical intelligence, egocentrism sets in all over again and then persists for several years. In the representative stage, the child is not limited by immediate perception as of the visual field but at the beginning of the next level of intelligence immediate perception is once again the rule. To avoid difficulties, a theory of temporal displacement is suggested: a new start is made at each higher level with a carryover of gains at the lower level. A somewhat different viewpoint is implied in a later treatment of development levels and stages from the viewpoint of group operations (20).

The term sensorimotor intelligence is somewhat ambiguous as it includes perception, deduction, and experimentation, particularly at the representative stage.

Among points of interest to developmental theory are residuals and regrouping. Residuals are lower-level behavior patterns persisting at the next higher level. They indicate overlapping level characteristics. Dissociation and regrouping, as briefly mentioned by the author, reflect reversibility of operations since they indicate a reorganization of learning during development.

H. J. M. Baldwin's Influence

Piaget shows here considerable preference for Baldwin's concepts. Circular reactions are derived from Baldwin who, in turn, was stimulated indirectly by Pflüger. Incidentally, Miller and Dollard overlooked Piaget in a survey of literature on circular reactions and imitation (10). Baldwin wrote on genetic logic and on genetic epistemology (2, 3). Those fields have also been interests of Piaget (22). Baldwin's genetic theory of reality also stimulated him (4). Baldwin formulated axioms and postulates for genetic science and development. Piaget is also trying to develop models in the fields of logic and of knowledge theory for application to psychology. Baldwin wrote about prelogical thinking with reference to the individual, independently of Levy-Bruhl. Piaget drew upon both Baldwin and Levy-

Bruhl for his interpretation of egocentric thinking, preconcepts, and early logical operations. Piaget also cites Baldwin considerably in relation to imitation. Baldwin wrote also about assimilation and accommodation in a way which anticipates Piaget's treatment of those concepts as in relation to schemata in experimentation.

I. Experimental Design

This book's methods and procedures are typical of the author's work. The main object here is to secure observations concerning development of the same children over a period of several years during the early life period. This is an improvement over the author's other work where the same subjects are not usually followed through over an extensive period. The observations of the author's three children are comparable on the basis of problem, response, theory, and age-level so that a comprehensive analysis and comparative study might have been made showing individual development profiles and progress. But Piaget has not emphasized individual differences. He has been more interested in the nature of development and its stages, and in concepts more than in the individuals.

Acuteness of observation and sensibleness of interpretation are considered by him to outrank any superficial statistical treatment.

This book discusses many hypotheses and it is certainly most stimulating. With each reading, one comes across different points and new perspectives. Just as Michotte found Piaget's treatment of the concept of causality useful in his own experimentation, so will research psychologists and others find blueprints for inquiry here.

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